NATIONAL PETROLEUM NEWS

February 2, 1944

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Secretary Hull Seen Emerging as Boss of Foreign Oil Policy

By Herbert Yocom, Chief Washington News Bureau

WASHINGTON—Important developments in foreign oil were widely predicted here this week and included the possibility that fast and early-breaking events would witness the triumphant though belated emergence of Secretary of State Hull as the dominant figure in the shaping of a post-war petroleum policy for the U.S.

On the whole, the situation was completely confused. Rumors were a dime a dozen in oil circles and take your pick.

Lending substance to the report concerning Secretary Hull was the fact that he had a conference scheduled for Wednesday, Feb. 2, with the top executives of several of the American oil companies having interests abroad.

State Department officials were reluctant to discuss the significance of the get-together with the oil men. They asserted it was to be a "purely informal" affair, held only for the purpose of getting acquainted and to provide Mr. Hull with the opportunity of assuring the operators that his department was "actively interested in foreign oil."

Ickes' Role in Doubt

Outside sources attached greater import to the gathering, however, and freely forecast that the secretary would use the occasion to make it plain to the oil executives that authority over all foreign problems, including that of oil, is centered in the Department of State and nowhere else. Should this be the case, then it could only mean, these sources said, that the President has finally concluded that the only way in which the fears of the American oil industry as to future U.S. oil policy can be allayed is to return ultimate control over that policy to its traditional place of abode—in the bailiwick of Mr. Hull.

What effect this would have on the activities of Petroleum Reserves Corp. and its president, Interior Secretary Ickes, was the subject of much conjecture. Some said PRC probably would continue to operate, but along lines and in accordance with policies dictated by Secretary Hull, after consultation with Mr. Ickes and other members of PRC's board of directors.

One thing certain, in the meantime, was that there has been no apparent letup of activities on the part of PRC.

Holds Series of Meetings

Its board met twice last week and again on Tuesday, Feb. 1. There were several reports as to what it was working on, including one that it has under consideration a new plan, authored by Commodore A. F. Carter of the Army-Navy Petroleum Board, for government participation with industry in a development of Kuwait and Saudi Arabian reserves.

No confirmation was forthcoming from PRC, but Interior Department spokesmen indicated that a statement of some sort might be issued later in the week by Secretary Ickes.

Reports published in New York to the effect that the government contemplates undertaking with industry, in the Middle East, "the biggest single development in the history of the oil industry" were discounted here. The New York reports were that the project involves construction of a network of pipelines from the Persian Gulf to Mediterranean ports and erection of several new refineries, at a cost of "several hundred millions of dollars", but NPN learned that no such development is being considered by PRC.

P.I.W.C. Holds Session

Also meeting here this week was the P.I.W.C.'s 16-member national oil policy committee, chairmaned by John A. Brown, president of Socony-Vacuum Oil Co. The committee held an all-day session Jan. 31 and is expected to make a progress report to P.I.W.C.

Members of a five-man Senate Interstate Commerce subcommittee went ahead, meanwhile, with the making of plans for early hearings on S. J. Res. 110, introduced by Senators Moore, of Oklahoma, and Brewster, of Maine, calling for the dissolution of PRC. Subcommittee plans called for holding of a preliminary session Feb. 4 or 5 to arrange a schedule and list of witnesses.

Members of the group which will consider the resolution are Senators Johnson, Colorado, Wheeler, Montana, Reed, Kansas, Brooks, Illinois, and Moore.

Oil at the Fighting Front---

A Navy seaplane being fueled by a 100-octane tank truck at the water's edge on a South Pacific island. Approximately 161 U. S. refineries are now, or shortly will be, engaged in the production of this vital fuel for United Nations' aircraft battling the Axis on world-wide battle fronts

WAR PROVES
THE WORTH OF

MEN AND MACHINES!

DAY BY DAY, the blustering claims of our enemies that Americans are soft and incapable of standing up against the cruel demands of modern war are methodically exploding in their faces. For the record of our gallant fighting men, as well as our home front civilian army, proves that free Americans, fighting for the right, have the power and the stamina to overcome any obstacle.

Machines, like men, meet their greatest test in war, and American-made war machinery is proving its worth on every battlefront. At home the rigors of rationing have imposed terrific demands upon civilian equipment. Practically no gasoline pumps have been built in the past two years. Tokheim pumps—15 and 20 years old—which would have been replaced long ago under normal conditions—are being operated day and night on 'round the clock schedules. The faithful performance of these Tokheim veterans is the pride of the Tokheim family of workers. It tells more eloquently than words of the quality Tokheim has always designed and built into its products. It's not a happy thought, but it's true that war proves the worth of men and machines.

TOKHEIM OIL TANK AND PUMP CO.
DESIGNERS AND BUILDERS OF SUPERIOR EQUIPMENT
FORT WAYNE FOR 43 YEARS INDIANA

ARMY NAVY KEEP ON BUYING WAR BONDS!

QUALITY TOKHEIM GASOLINE PUMPS

Don't let anyone give you a PT boat after the war. You'd go broke buying enough gasoline for her hungry engines. But right now, no price is too high to pay for added speed and power for our fighting PT crews.

How far could a "PT" go on an "A" ticket?

▶ A month's supply of "A" tickets would allow barely enough gasoline to warm up the three huge engines of one of these Jap-smashers. And it would have to be high octane gasoline to be of any use at all.

The point is that all our gasoline fighting machines—land, sea and air—require enormous quantities of high octane fuel. And that's why there's less gasoline in the U.S.A. for civilians—and less Ethyl fluid to raise its quality, in spite of stepped-up Ethyl production.

Every gallon of America's fighting gasoline contains Ethyl fluid. Not only is more Ethyl fluid needed for more gallons of aviation gasoline, but more of it is going into each gallon.

Today, more and more Ethyl is going overseas. But someday—*after the war*—this high octane gasoline will stay home. Result: gasoline for automobiles, airplanes, trucks, buses and tractors of higher quality than Americans ever enjoyed before. Ultimately engines will be designed to take full advantage of this gasoline.

In this post-war development, the Ethyl Corporation looks forward to playing a special part. Through our Detroit and San Bernardino laboratories, now busy with war work, we plan to work closely with automotive, aviation, tractor and petroleum engineers—helping them to get the most from post-war gasoline and engines.

ETHYL CORPORATION

Manufacturer of Ethyl fluid, used by oil companies to improve the antiknock quality of aviation and motor gasoline

CHRYSLER BUILDING, NEW YORK CITY

William C. Wenzel . . .

Named "Penn Grade" Assn. Secretary

NEW general secretary of the 21-year old Pennsylvania Grade Crude Oil Assn. is William C. Wenzel, widely known in the petroleum industry.

A native of Newburgh, N. Y., Mr. Wenzel for the past two years has served as executive secretary of the extra transportation expense managing sub-committee of Dist. 1. Prior to 1942 he was for eight years in the executive offices of Dun & Bradstreet, Inc., New York, as manager of the petroleum division. His earlier experience included service with Richfield Oil Corp. where he was assistant treasurer, and with Crucible Steel Co., in their treasury department.

As the successor to S. F. Pratt who resigned as secretary of the Pennsylvania Grade Assn. at the end of 1943 to join Union Trading Co., Inc., New York, Mr. Wenzel will be closely associated with the organization's president, D. T. Andrus, Bradford, Pa.

They will work together to further the interests of an association which has maintained uninterrupted advertising of Pennsylvania motor oils since 1922.

NEW WARTIME EDITION
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Hero's Letter Aids Drive For Scrap Metals

NPN devoted several of its covers to a campaign we hoped would promote scrap collection, segregation and shipment to steel mills where it is urgently needed. Then the editors looked around for a final "punch"—something to wind up the ad series with a message so strong that it would reach the heart of every oil man. We found it in a stirring letter from an American sailor who wrote "the whirling thoughts that came to my mind" from a hot jungle in the South Pacific. We knew it was good, but we didn't know how good—until we printed it (*NPN Jan. 12, 1944*). Since then letters have been coming in from all over the country, asking permission to reprint the letter, asking for extra copies, praising NPN for broadcasting the message of Kenneth Walsh, the American sailor whose letter inspired NPN's slogan: "There is Still Need for Scrap to Help the Men Who Get $50 a Month, Room and Board".

One of the letters NPN got was from L. H. Bond of the Bond Pickle Co., Oconto, Wisc. That's a far cry from gasoline & oil, but here's how it happened:

"One of your subscribers, the Sorenson Oil Co., let me take the January 12th copy of the NATIONAL PETROLEUM NEWS," Mr. Bond wrote. "The article by Kenneth Walsh which starts on the front cover is, without question, the most powerful, soul-stirring message I have ever seen. . . . The writer would like permission to reprint this article at my expense; thousands of copies of it; and see that they are distributed to thousands of people. . . . May I reprint and distribute far and wide?"

Support the 4th War Loan Drive!

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NATIONAL PETROLEUM NEWS

February 2, 1944
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Report Cal-Arabian Makes Deal with PRC

Two Versions of Arrangement Rumored: 1—PRC Bought Stock in Company; 2—PRC Simply Granted Operating Loan

NPN News Bureau

NEW YORK — Petroleum Reserves Corp. finally had effected a deal with California-Arabian Standard Oil Co., according to rumors in industry circles here Feb. 1. There was no confirmation, but one top PRC official in town did not deny that an agreement had been reached.

Two versions of the arrangement are reported: First, that PRC has succeeded in purchasing a stock interest in Cal-Arabian, perhaps one-third; second, that PRC simply has granted the company an operating loan, mentioned at $15,000,000 to $20,000,000. The latter report is more in line with the recent history of negotiations; it is reported that the government for months has been trying to buy into the company, but that both Standard Oil of California and The Texas Co., Cal-Arabian parent bodies, have refused to accept government partnership. Stock purchase now would represent a policy change on the part of the companies themselves, it is pointed out. However, such a change is possible if Cal-Arabian officials have come to the belief that adequate diplomatic protection for the interests in Saudi Arabia can be assured only through direct government association.

There is also doubt as to the nature of the deal, if it has been made. Some industry leaders feel that construction of facilities in Saudi Arabia would be held up for the present due to shortages of materials, while others feel that construction of pipelines and refining equipment would be undertaken immediately. It is generally believed that Cal-Arabian would not undertake the risk of confiscation of extensive installations in Saudi Arabia unless assured of some measure of government protection.

Foreign Production Equipment Requirements To Exceed U.S. on Proportionate Basis

NPN News Bureau

WASHINGTON — Foreign needs for oil drilling equipment will exceed domestic requirements on a proportionate basis during 1944, PAW Materials Director Watts reported Feb. 1 to P.I.W.C.'s production committee in session here.

Mr. Watts said that while only about 5% as many wells will be completed in foreign fields it is anticipated that between 10% and 15% as many rotary rigs will be operating abroad by the end of the year as will be operating in this country.

Considering both foreign and domestic needs for oil well drilling machinery and production equipment, demand continues to exceed supply, Mr. Watts told the committee. He gave assurances, however, that there is no plan at present to permit production of civilian items which might disrupt essential war programs such as that in which the petroleum industry is engaged.

He pointed out that shortages of internal combustion engines, engine parts, bearings, castings, forgings, trucks, truck parts and certain electrical items continue and as long as this situation exists petroleum operators can expect disruptions in their operations.

Alloy steel bits now used compare favorably with pre-war types and tests now are being initiated to determine whether present steels are inferior or superior to pre-war SAE 4815 steel, he said. He advised operators who are experiencing delays to submit detailed information promptly to PAW so that it can work with WPB, equipment manufacturers and others to improve the quality of steel in order to prevent delays in drilling operations.

Mr. Watts reported that the average number of rotary rigs in operation during the last few weeks has exceeded 1300, not including those moving from one location to another, tearing down or rigging up. He revealed that plans are being made for operating 1740 rigs during the first quarter of this year, 1760 in the second quarter, and 1810 in the second half of the year. He estimated that 3,900,700 ft. of drill pipe will be needed in the first half of the year and 1,726,000 in the second.

Backlog of tool joint orders has increased from 183,300 to 195,200 during the past three weeks, Watts said. Production of tool joints, he added, has been increased by 1500 per week during the past six weeks.

Barnsdall Eyeing Venezuela

NPN News Bureau

NEW YORK—Barnsdall Oil Co. announced Jan. 26 that it is investigating the possibility of acquiring and operating concessions in Venezuela. James A. Dunn, company vice president in charge of the New York offices said a group of company representatives was being sent to Venezuela to study the situation.

"We are just looking over the ground", said Mr. Dunn. "There are no definite plans yet."

He said decision on the Venezuelan project might be expected before April 1.

OPA Drafts Subsidy Plan At Vinson's Request

NPN News Bureau

WASHINGTON—With PAW's failure to find any workable subsidy scheme for wildcat and stripper well operations, in lieu of a general crude increase, there was every indication this week that the job has been turned over to OPA by Economic Stabilizer Vinson and that the price agency already has the nub of a plan down on paper.

A plan that would offer "inducements" to wildcat and stripper well operators to increase production has been under consideration by OPA for several weeks, but particulars could not be learned as NPN went to press.

While it is believed that the nucleus of such a plan has been presented to Judge Vinson, he is understood to have requested more details, and these will probably be forthcoming within the near future.

Meantime, there was still no prospect of early hearings by the Senate Banking and Currency Committee on either of the two crude price increase bills which have been referred to it.

Visiting President Visions Venezuela's Expansion

NPN News Bureau

NEW YORK — Venezuela is embarking on a policy of stepped-up industrialization, President Isaias Medina-Angarita announced during a visit here from Jan. 25 to Jan. 31. He said Venezuela would order the construction of oil refineries on Venezuelan soil, but added that he wished his country to expand in industrial fields other than oil.

"The Venezuelan government will aid industrialization by facilitating credits, lending money in great lump sums, and granting lower rates on longer terms through the industrial bank," he said. "We could not offer anybody special privileges or unreasonable profits, but we can assure treatment of irreproachable equity to those who bring their capital and initiative into association with ours, and with our labor, on an equal basis for the development of the country."

President Medina said he hoped that the bulk of Venezuela's postwar trade could be routed to the U. S.

The president and his party were guests of the Standard Oil Co. (N. J.) at a dinner and were feted by several other organizations, including International Business Machines, on their visit to this country.

10% Increase in Truck Production During 1944 Revealed by Eastman at Chicago Conference

NPN News Bureau

CHICAGO—ODT Director Eastman, speaking before 500 truckmen at the fifth annual convention of the National Council of Private Motor Truck Owners, Inc., held here Jan. 27-28, raised the ante on 1944 truck production for civilian use by 10%. Expected manufacture, he said, will total 88,000 new units. Previous announcement by WPB placed 1944 truck production at 80,000 units.

Mr. Eastman compared the 88,000 figure with the combined 1942-43 sale of 100,000 trucks and 1941 sale of 700,000.

Other speakers on the convention program included representatives of Selective Service, the Rubber Director, U. S. Army transportation, ODT, truck manufacturers and allied industries and truck traffic men.

Breakdown on the 88,000 truck production figure for 1944, was given by E. M. Brady, assistant director, motor transport, ODT, in a speech made at an early session, as 60,000 medium capacity trucks, 22,000 heavy duty and the remainder, light trucks, along with 25,000 trailers of all classes, which Mr. Brady said will also be released.

Sums Up Resources

Mr. Eastman pointed out that the trucking industry is in a tough spot and that it will take maximum co-operation to get out with a whole skin. Four things in truck transportation impressed him, he said: The degree to which domestic economy and war effort are dependent on truck transportation; war loss of natural rubber sources; the fact that trucks and truck equipment come more directly and more extensively into competition with urgent military demands for similar supplies than any other form of transportation, and the dire financial distress of for-hire carriers.

A summary of certificates of war necessity, he said, showed that there are about 4,635,000 trucks and truck tractors in the country in the hands of about 3,267,000 certificate holders and that we have certified to these trucks about 47,900,000,000 miles per year, which figures include some passenger cars converted to property-carrying use. Of these vehicles, about 4,011,000 are private trucks, with about 2,903,000 certificate holders. Added to this are 624,000 for-hire trucks with about 364,000 certificate holders. Of the private trucks, 1,588,000, with 1,527,000 certificate holders, are farm trucks, leaving 2,423,000 with 1,376,000 certificate holders for other purposes.

For-hire trucks were only 13.46% in number of total but accounted for 26.08% of mileage. Farm trucks were 34.26% of total in number and accounted for 25.91% of mileage. While there were about 2½ times as many farm trucks as for-hire trucks, the latter were responsible for more mileage. Other private trucks were 52.28% in number and accounted for 48.01% of mileage.

ODT certified mileage, he continued, reflected an over-all saving under conservation activity of something like 20% compared with 1941. Estimated saving of private carriers, exclusive of farm trucks, has been better than 25%; wholesale and retail operations, better than 30% average, with some cases recorded at 40%.

Active promotion of joint action plans offers best opportunity for further conservation, in his judgment, as excellent results have been worked out in delivery of coal, petroleum, dairy and similar products. Advisory committees that are helping in this conservation work total 152 in the for-hire field with a total membership of 582; 1,163 committees in the private carrier field, apart from farm trucks, with total membership of 6,452; 478 dairy committees, 2,108 livestock committees and 18,088 County Farm Transportation committees in the farm vehicle field with a total membership of 86,849. All told, 22,997 committees with grand total membership of 99,213. With all this help, he asserted, we can hardly go wrong.

Hershey's Address Read

Maj. Gen. Hershey's address on Selective Service, read in his absence by Commander P. H. Winston, his executive assistant, warned truck owners that the immediate future of manpower will not be easy but that Local Board Memorandum No. 115, effective Feb. 1, emphasizes that a father over 21 years old who is making a contribution to war production or in support of the war effort is usually a stable employee and, if other factors are equal, will normally be accorded deferment in preference to fathers in the ages 18 through 21. No registrant from 18 through 21 years old, he said, may be considered as a necessary man entitled to be placed in Class II-A or Class II-B unless he either comes under a national exception or request for his deferment is supported by the recommendation of the State Director of Selective Service.

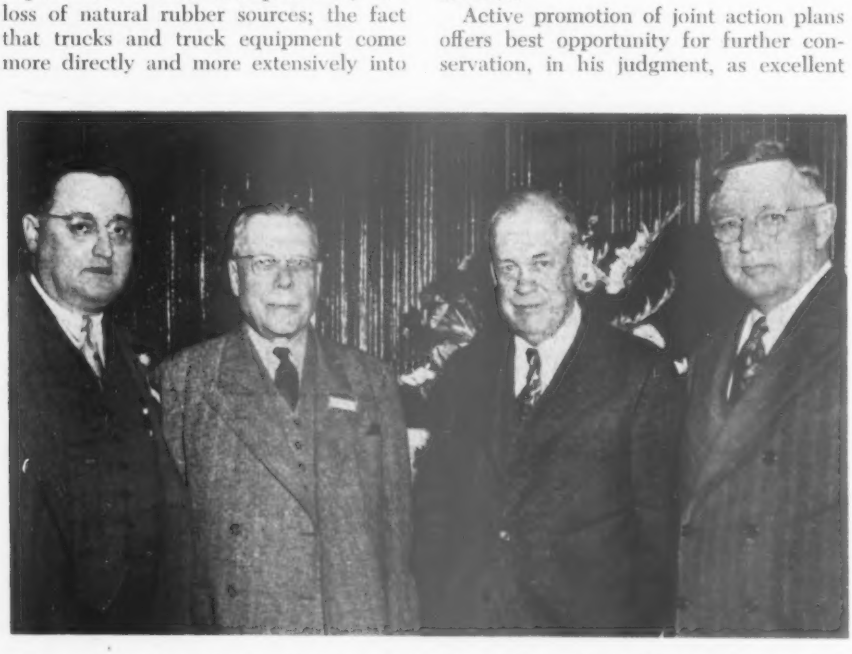
Industry has been told that it must prepare to release young registrants and single registrants in order that they may be available for induction so that no more fathers will be inducted than is absolutely necessary, he asserted, adding that industry will have to tighten its belt and release them.

In answer to a question, Col. Winston told the assembly that in the case of the salesman-driver of private trucks, the driver might be considered essential but not the salesman. Final decision would rest on whether or not he could be replaced.

While much of the equipment now transporting petroleum over the highways has been used beyond its normal economic life, petroleum carriers cannot expect anything but limited replacements for the duration, Maj. Gen. Charles P. Gross warned in a speech read in his absence by Col. F. C. Horner, chief of the highway division of the transportation corps of the U. S. Army. Gen. Gross cautioned against the continued relaxation of speed limits, which he said was now threatening.

Billion-Mile Savings

Continuing on the truck tire situation, he said estimates indicated that more than 11 billion truck miles were saved by private truck operators in 1943 compared to 1941, which represents a savings of approximately 2,000,000 truck tires. This was accomplished by joint action



Oil men serving as directors on the National Council of Private Motor Truck Owners, Inc., shown with ODT Director Eastman, who spoke at a luncheon at their fifth annual meeting held in Chicago, Jan. 27-28, are: Leo Huff, Pure Oil Co., Chicago; F. E. Packard, Standard Oil Co. (Ind.), Chicago; Mr. Eastman, and J. F. Winchester, Standard Oil Co. of N. J., New York

plans, better routing and every other conservation.

Many army installations are wholly dependent on tank trucks owned and operated by private carriers for their fuel requirements, he said, and in order to take care of these requirements and civilian needs, tank truck operators must continue to practice conservation.

Presenting the outlook on the truck tire situation at another of the council's sessions during their two-day conference, L. D. Tompkins, deputy rubber director, told truck operators that they faced the tightest squeeze in the truck tire situation, and that it would come during the next few months. The situation, as he expressed it, is not yet "critical" but is definitely "serious". The country still has tires on more than 4,000,000 trucks and now has recapping facilities and supplies available to recap at the rate of over 5,000,000 truck tires and 25,000,000 passenger tires per year. It will be able to produce enough to equip authorized new trucks and to supply replacements to those that absolutely need them. Natural crude rubber stocks, Tompkins said, are down to 140,000 tons to which can be added an approximate 80,000 that will be imported during 1944. Estimates place the amount of absolutely essential forages into this stockpile at 170,000 tons for the entire year, leaving only 50,000 tons of natural rubber on hand at the end of 1944.

Manpower No Better

Particularly grave scarcity of mechanics and shortage of transport drivers will probably get worse before it gets better, E. M. Brady, assistant director, Division of Motor Transport, ODT, warned operators. Everything possible is being done by ODT, he added, but establishment of employee recruitment and training programs among the carriers themselves will help immeasurably in the solution of the problem. He did, however, offer a ray of light to the harassed transporters with his explanation that the material situation for the manufacture of parts is considerably improved, although conservation is still extremely essential.

Further warnings on the present confused transportation outlook were offered by Robert F. Black, president, White Motor Co. Telling his audience that they now faced a supreme challenge, he said that there were 100,000 miles more served in every heavy duty truck and 5,000 miles more in every tire now in use. The next six months, he said will be the test and may show up as the Achilles heel. Winter ice and snow will take their toll and operators have only green men to combat them.

Pyke Johnson, president, Automotive Safety Foundation, told his listeners that road conditions were now in their favor, since passenger traffic had been cut in half but the postwar period would probably find them caught in a traffic jam. Then, too, he said, accidents are on the increase and last October's totals exceeded those of October of previous year, despite decrease in traffic mileage.

N.C.I.P.A. Group Tags Disney Bill as Inadvisable; Hails Nomination of Phil Williams to P.I.W.C.

NPN News Bureau

CHICAGO—Phil T. Williams, president of the National Council of Independent Petroleum Assns., has been appointed by PAW the 74th member of P.I.W.C. in recognition of the council's "wide representation of the independent element of the petroleum industry."

Announcement of Mr. Williams' appointment came shortly after a meeting of N.C.I.P.A.'s executive committee here Jan. 25, at which members voiced the opinion that the Disney bill is inadvisable. Congress should not be permitted to have the job of setting prices of commodities, the members reasoned, thus echoing the thoughts of Sen. Ed. Moore, Okla., who opposed the Disney bill in a radio talk from Ft. Worth early in January (*NPN Jan. 5, p. 8*).

The executive committee adopted a resolution favoring higher crude prices, however, with the proviso that no crude oil price increase should be allowed unless corresponding increases in product prices are permitted.

Think Method Was Wrong

Reporting the discussion of crude prices in his minutes, N.C.I.P.A. Secretary George Hofmayer said: "Those in attendance were of the opinion that the council favored an increased price in crude . . . but they were of the opinion that the method was wrong, i.e., that if once Congress starts setting the price on commodities there will never be any end to this procedure . . . It was thought that the proper way (to bring about a crude price increase) would be to have congressional pressure put on OPA and have them recognize the need for increased price of crude."

The N.C.I.P.A. hailed Mr. Williams' appointment to P.I.W.C. as a "great victory" and called upon state marketer associations which have not joined the independent council to become members "so that we can increase our representation still further for the interest of the independent oil man."

Mr. Williams, of Gaseteria, Inc., Indianapolis, will serve without compensation for the duration.

Announcing PAW's appointment of Mr. Williams to the presidents and secretaries of member associations, the N.C.I.P.A. said: "We have struggled along for two or three years with one main objective in mind, and that was to pool the resources of the different state and national independent oil marketing associations into one common council so that they could weld their voices for the purpose of defending, protecting and advancing the interests of the independent oil distributor. We are pleased that Mr. Ralph K. Davies, deputy administrator for war, has recognized the breadth and scope of the council's activities and the wide representation it now has of the independent oil men in America."

Other matters discussed at the executive committee's meeting here included allocations, premium gasoline, and a revision of N.C.I.P.A.'s by-laws.

Discuss Allocation Plan

Ross Schoolroy, of Fair Price, Inc., Wooster, Ohio, member of the subcommittee appointed to draft a proposed allocation directive for Dist. 2, discussed its provisions at the meeting. It was brought out that as it now stands, the directive would stop allocations with the primary suppliers, using 1941 as a base period for determining the allocation for each. N.C.I.P.A.'s executive committee went on record in opposition to halting allocations with the primary suppliers and recommended that the allotment allowed each secondary supplier be guaranteed with the following language:

"Each secondary supplier shall receive a percentage of his original supplier's allocation based on the following formula: The sales in the corresponding month in the year 1942 for all secondary suppliers of an original supplier shall be totaled. Such total to be divided into each secondary supplier's sales figure to arrive at a percentage, which percentage shall be used to calculate the share of products to be made available to him for the current month."

Mr. Hofmayer reported that the committee discussed the elimination of Ethyl gasoline, "which is supposed to come about in the immediate future," and agreed that N.C.I.P.A. should take the position immediately that regular grade gasoline price ceilings must be advanced if and when premium grade is eliminated.

Allots Hardship Gasoline

Special to NPN

BOSTON—OPA has allotted New England 225,000 gals. of gasoline for "unusual hardship" cases for the month of February. Stipulation is that no appeal is allowed motorists who are refused emergency fuel by their local boards, although one member of a local board can authorize the extra allotment. Hence, if any board member refuses an applicant's request, the car owner has the right to canvass the other board members.

None of the extra rations will be issued for occupational purposes or for purposes now allowed under current regulations. Hardship cases are defined as those of "extreme personal or family emergency".

South Carolina Jobbers Resent 'Oil Policy for One Class'

Special to NPN

COLUMBIA, S. C.—The South Carolina Oil Jobbers Assn. turned its annual meeting here Jan. 20 into a forum with PAW Dist. 1 officials in an effort to iron out some of the pressing problems now

confronting Southern distributors.

Consensus was that the independent stratum of the industry was not being consulted by attorneys loaned to PAW by the majors. "These attorneys," said one association official, "are the real men behind the guns and are familiar only with the problems of the major operators, consequently, their policies and regulations are shaped to fit only one class."

The South Carolina group expressed almost unanimous belief that until the independent jobber, "through organized effort and political influence," obtains his place on policy-making committee there is little chance for the formulation of directives and regulations which will give them equality with the majors in distribution.

The association indorsed the appointment of Hubert M. Howell, of Howell-Hollowell Oil Co., Goldsboro, N. C., to the S. and D. working unit in Charlotte, N. C., for Zone 4.

The South Carolinans are also protesting the recent appointment of one of two members from that state to the gasoline jobbers subcommittee of Dist. 1's marketing committee. Letters have been exchanged between the South Carolina group and W. L. Kallman, secretary of the petroleum industries committee for the Dist. 1 marketing committee, in which the jobbers complain that the appointment is not that of a bona fide distributor but a peddler. Mr. Kallman has advised the association that the resignation will not be asked.

Present with the South Carolina group were John Harper, marketing director for Dist. 1; S. B. Wilkes, assistant to the director-in-charge of Dist. 1; John E. Dozier, PAW's Zone 4 representative, and Cy Hornsby, manager of the S. and D. Zone 4 committee.

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Individually Branded Dealers Of 12 States in Rally

Special to NPN

INDIANAPOLIS—About 60 members of Individually Branded Petroleum Assn. from 12 states held a 2-day meeting here Jan. 26-27. Product allocation, possible industry changes to one grade of motor fuel for civilian use, wartime restrictions and postwar planning were discussed. Conclusions reached were not disclosed. All directors and officers were continued in office.

Co-Op's Sales Hit Record High

NPN News Bureau

CLEVELAND—Refinery sales of Consumers' Cooperative Refineries, Regina, Sask., for the year ended Nov. 30, 1943, reached an all-time high of $2,276,704.94 —an increase of $94,888.10 over the previous year's sales.

Gasoline sales for the 12-month period totaled 10,571,810 gal.; sales of fuel oil totaled 4,031,698 gal.; and the sales of lubricating oil reached a new high of 508,588 gal. Grease sales amounted to 816,797 lbs.

Total assets of the refineries were set at $1,477,103.49, an increase of $49,-859.36 over 1942.

Bigger Postwar Market In Oil Heat Sighted In Milwaukee Session

Special to NPN

MILWAUKEE—First state-wide rally and banquet of fuel oil industry men was held in the ballroom of Wisconsin Hotel here on the evening of Jan. 27, under the sponsorship of Wisconsin Oil Heat Assn. More than 100 suppliers and distributors of oil and oil burning equipment and representatives of OPA and WPB attended.

An address by W. A. Matheson on business in the postwar era, was delivered by T. H. Green, due to the illness of Mr. Matheson, who is vice president of Williams Oil-O-Matic Heating Corp., Bloomington, Ill., and chairman of the Oil Heating Institute postwar planning committee. Mr. Green is personnel director of the same company.

Mr. Matheson listed five basic factors affecting the oil heat business after the war, supply, specifications, oil burner or product, market and sales or penetration of the market.

Quoting from a report by the advisory and postwar planning committee of institute, he asserted petroleum supplies would be more adequate for the measurable future. So far, he added, the committee has found no basis to expect radical changes in oil specifications, but there may be some modifications between grades, accompanied by adjustments in price structure.

No Competitive Changes

"But there appears to be no current reason to look for any changes of the price structure which would change the competitive rating of oil compared to other fuels, postwar," he said, citing the report.

"The petroleum import-export equation," he continued, "now appears even more favorable than the conclusions offered in our October report. In Russia the development of their own oil resources appears to be under way. One refinery now under construction is reported to cover from 10 to 12 sq. mi. The Arabian fields controlled by Coltex are also being actively developed."

Production of South American and Mexican fields has been increased to 665,000 b/d, he said, and actual production of the MacKenzie fields area has so greatly exceeded anticipation that one of the interested companies has recently published a statement that the field merits ranking as a major producing area.

"New Oils Harder to Ignite"

Concerning oil specifications, he said that as a result of the constant trend toward higher octane ratings for gasoline, future distillates probably would be of about the same viscosity as in the past, but would have higher flash and fire point and higher end points.

"This means," he added, "that they will be harder to ignite, since it will take more heat to touch them off. By the same token they will be safer, which should lead to a relaxation in the local codes governing oil storage, permitting larger tanks and better oil delivery practice."

These harder-to-ignite and harder-to-burn oils, he said, make one conclusion obvious—better burners will be needed. Ignition assemblies will have to be so constructed as to be surer of instant ignition. Moving parts in contact with the dirtier oils will need to be tougher and more resistant, due to the abrasive qualities of such oils.

Firing Rate to Be Cut

More efficient heating plants will be found in after-the-war homes, which it was said would average about six rooms. The firing rate, it is anticipated, will be cut to half to three-fourths of a gallon per hour for the average, and less than a half gallon on many. Boiler and radiator manufacturers and manufacturers of warm air heating equipment share in this opinion, Mr. Matheson said.

He said the replacement market for burners in Wisconsin alone should eventually reach 2500 to 3000 units a year. "There is still a tremendous market in Wisconsin for conversions to oil since only 5% of the homes with central heating plants are yet burning oil," he concluded.

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Moves to Put Brakes on Draft Of Midwest Truck Employes

NPN News Bureau

CHICAGO — Wisconsin and Illinois truck operators will be aided in their effort to keep trucks moving by instructions of Col. John F. Mullen, state director of Selective Service, to local draft boards. Col. Mullen has directed draft boards to give "serious consideration" to the essential status of motor carrier employes, according to Harry L. Gormley, regional ODT director of the division of motor transport.

Results of a survey conducted by ODT, the bureau of motor carriers of the Interstate Commerce Commission, and the War Manpower Commission, indicate that continued drafting of trucking employes will cripple that section of industry engaged in support of war effort, Col. Gormley said. The survey showed that among 753 for-hire motor carriers operating in Wisconsin, Illinois and Indiana, 942 out of 15,360 trucks, or 6.1% were idle because of lack of drivers and mechanics.

If present rates of induction continue, according to the survey, 32% of the drivers will be lost to industry since 753 carriers employed 14,899 drivers, of whom 4847 had been ordered for induction or had been classified 1-A. One cause of this heavy induction of drivers and mechanics, Col. Mullen's directive points out, is the negligence on the part of employers in filling out 42-A forms for their employes who are governed by patriotic reasons.

Crude Sharing by Midwest Refineries Dips During February

NPN News Bureau

CHICAGO—Dist. 2 crude oil to be shared by the "have and have not" refineries for month of February shows a total of 47,590 b/d, according to schedule released today by PAW. Total for January was 64,690 b/d. February schedule follows.

SUPPLYING COMPANY	RECEIVING COMPANY	B/D
Aetna Oil Co.	Louisville Refining	500
Socony-Vacuum, Detroit	Naph-Sol Refining	300
Carter Oil Co.	Kanotex Refining	500
Texas Co.	El Dorado Refining	750
Texas Co.	Johnson Oil Supply	1200
Skelly Oil Co.	El Dorado Refining	1800
Sinclair Refining Co.	Sun Oil Co.	9000
Sinclair Refining Co.	Worth Refining	2660
Standard Oil Co. (Ind.)	Bay Petroleum	750
Standard Oil Co. (Ind.)	Derby Oil Co.	250
Shell Oil Co.	Derby Oil Co.	1000
Roosevelt Oil Co.	Midwest Refineries	875
Phillips Petroleum Co.	Champlin Refining	2000
Simrall Corp.	Lakeside Refining	540
Simrall Corp.	Marvel Refining	400
Simrall Corp.	Old Dutch Refining	1000
Simrall Corp.	Osceola Refining	200
Ohio Oil Co.	National Refining	2300
Gulf Oil Corp.	Arrow Petroleum	365
Deep Rock Oil Corp.	Midland Co-Operative	200
Cities Service Oil Co.	El Dorado Refining	1500
Bay Refining Co.	Marvel	400
Allied Oil	Petroleum Specialties	1000
Standard Oil Co. (Ohio)	Advance Refining	1750
Standard Oil Co. (Ohio)	Cascade Refining	300
Standard Oil Co. (Ohio)	Louisville Refining	200
Standard Oil Co. (Ohio)	Midwest Refineries	950
Standard Oil Co. (Ohio)	National Refining	1000
Standard Oil Co. (Ohio)	Pana Refining	400
Standard Oil Co. (Ohio)	Rock Island	500
Standard Oil Co. (Ohio)	Stoll Oil	1000
Pure Oil Company	Rock Island	2000
	Sub Total	37,590
From Big Inch at Norris City, Ill.		
	Arrow Petroleum	1000
	Globe Oil	3250
	Louisville Refining	1500
	National Co-Operative	1500
	National Refining	2750
	Grand Total	47,590

Tests Show War 'Gas' Has Mileage Edge But Ping Is Greater

NPN News Bureau

LOS ANGELES—A question frequently asked of service station operators these days is: "What does this new war-time gasoline do to my mileage and my car?"

To answer the question the Automobile Club of Southern California assigned its Assistant Chief Engineer Hal Holley to find out.

In a nutshell the results of the tests were these: War gasoline will give slightly more mileage per gallon on the open road. Pre-war "gas" gave a trifle more mileage over a stop-and-go route. The new war gasoline gives a lot more irritating and harmful "ping" unless the motorist changes his driving habits.

For those who want figures on the tests the following are the results. In 1942 the same car driving non-stop at 35 miles an hour over an identical course averaged 20.67 miles per gallon. The average on 70-octane gasoline (war-time "gas") was 21.33 miles per gallon. At 30 miles per hour the pre-war fuel gave 21.28 m.p.g. as against this year's 22.45. At 25 miles per gallon the comparison was 22.27 as against 23.73, and at 20 miles per hour it was 22.02 as against 23.73 miles per gallon. From the figures it can be seen that at every speed tested the de-based gasoline gave the better mileage than the 1942 gasoline.

In the stop-and-go tests the pre-war gas averaged 16.51 miles per gallon at legal speeds in typical metropolitan Los Angeles driving, excluding heavily congested business districts. The war-time product averaged 16.48 miles per gallon or a loss of 3/100ths of a mile per gallon.

As a result of the tests the Automobile Club's engineers decided that the big difference between pre-war and war-time gasoline was not so much a matter of mileage but consisted mainly of one word, "ping".

In commenting on the experiments in the club's house bulletin *"Westwave"* this observation was made: "There are those who have held "ping" in contempt, thinking it is an irritation noise, but not harmful. Mechanics, however, will tell you differently. Something is happening in the motor to cause that noise and that something may be likened to hitting the piston head with a sledge hammer. Ping is harmful and when you hear it clattering it is well to remember that your motor's wrist-pins and bearings are taking a terrific beating."

"Ping" in the Auto Club's test car (a 1939 Dodge with a compression ratio of 6.5 to 1) was cut to a minimum by retarding the spark six degrees. However, when this was done the mileage per gallon dropped from 21.33 to 18.57 at 35 miles per hour.

Solution to the "ping" problem, the Auto Club suggests, is mostly with the motorist himself and his driving habits. "Ping" will prevail where drivers insist on quick getaways or push the throttle to the floor in passing other cars, or take all hills in high like they used to do with pre-war gasoline. On the other hand safely and sanely driven cars can lick the "ping" problem.

It is also suggested that properly tuned motors, with carburetors and timers adjusted to war-time fuels, and pistons that are free of carbon will help a lot.

Hancock Oil Earns $737,323.57

NPN News Bureau

LOS ANGELES—Hancock Oil Co. of California's net income for the last six months of 1943 amounted to $737,323.57. Operating charges, in which was included state, county and federal taxes, were $2,991,393.67.

S.A.E. First Society To Receive Award From Army Ordnance

NPN News Bureau

NEW YORK — The U. S. Army Ordnance Distinguished Service Award, first of its kind to be conferred, has been presented to the Society of Automotive Engineers "in recognition of outstanding and meritorious engineering and advisory services in war and peace." S.A.E. is the first professional society to receive such an honor.

Hundreds of S.A.E. members, as engineering representatives of automotive vehicle and parts manufacturers, have been active in the work of the S.A.E. Engineering Board, Transportation and Maintenance War Advisory Committee, Ordnance Vehicle Maintenance Committee and other S.A.E. groups.

In presenting the award, Maj. Gen. G. M. Barnes said that the pre-war work of the S.A.E. groups had helped make it possible for Ordnance "immediately to place its tanks and armored fighting vehicles under quantity production without delay." He explained that S. A. E. committees have handled more than 1000 engineering projects for the Army and Navy, the majority at the request of Ordnance.

Tide Water Buys 58 Etex Wells

NPN News Bureau

TULSA—Sale of 58 wells on 6 producing leases in the East Texas oil field for $2,500,000 cash was announced by N. T. Gilbert, general manager of Midstates Oil Corp., to Tide Water Associated Oil Co.

Daily allowable in the field is 20 b/d and the allowable is for 20 days a month, so the production sold averaged 1160 b/d or 23,200 bbls. a month, Mr. Gilbert said.

Remodeled MPR 137 Incorporates New Methods of Pricing

NPN News Bureau

WASHINGTON—OPA Jan. 26 issued a new, revised and simplified MPR 137 —the schedule covering prices of petroleum products sold at retail—henceforth to be known as Revised Maximum Price Regulation 137.

The revision is primarily a reorganization of the old MPR 137, to incorporate new methods of pricing that have been added to the original "freeze" formula.

No substantive changes were made in maximum prices under the regulation. Several changes in methods of determining maximums, however, are contained.

Most important of these are the provisions which furnish a simpler method of computing maximum prices for sellers who formerly determined their ceilings by adding 3c to their delivered costs, or by adding their Oct. 15, 1941, margins to their delivered costs.

If the 3c margin method is used, the 3c is to be added to the maximum tank wagon price of the reference seller for undivided dealers for the point at which the station is located. If the Oct. 1-15, 1941, margin method is used, the dealer is instructed to take the difference between his Oct. 1-15, 1941 service station price and the Oct. 1-15, 1941 tank wagon price of the reference seller, and add this difference to the reference seller's present maximum price.

Purpose of these provisions is to provide uniform, non-fluctuating ceilings that can be calculated without involved computation of delivered cost.

Liquefied petroleum gas sold as motor fuel at retail establishments may no longer be priced under the 3c margin provision.

WPB Warns: 'Keep Anti-Freeze'

NPN News Bureau

WASHINGTON — WPB's anti-freeze industry advisory committee, meeting here, strongly recommended that motorists preserve their present supply of motor vehicle anti-freeze for the 1944-1945 winter season.

Ickes and Associates Gloomy on Oil for East; Won't Predict Coupon Cut as ODT Toils

By James Collins
NPN Staff Writer

WASHINGTON — The nation's oil transportation system creaked and groaned this week under increasingly heavier loads of invasion-bound petroleum products, and the first signs of tighter gasoline supplies for civilians were aborning, especially in the East where, PAW Ickes said in his most pessimistic report in months, these supplies are now in a "precarious" position.

Mr. Ickes said PAW is deeply concerned over eastward petroleum transportation but hastened to add that no "predictions or scares" are involved. "Recent developments", he said, most of which could not be foreseen, have created new bottlenecks in moving oil products to the Atlantic Seaboard which threaten supplies of all petroleum products in the area.

Most pressing problem is the accelerated deterioration in car supply, despite the fact that increased pipeline movements, notably by Big Inch, have theoretically released thousands of cars. In actuality, however, these freed cars have been rapidly absorbed into other essential traffic with the net result that the pool of tank cars in East Coast service has thinned from nearly 70,000 a few months ago to about 60,000 today.

A further complicating factor has been the rapid falling-off of tank truck capacity, resulting from the progressive obsolescence of equipment, the critical shortage of repair parts, primarily motors, transmissions and differentials, and the impossibility of properly maintaining equipment in 196-hour-per-week operations.

A further serious factor in the East Coast picture has been the two-month delay in getting the "Little Big Inch" products pipeline into operation, due entirely to defective pipe, which may cut operating pressure in the line between 700 and 800 lb. psi. Testing of the western leg from Beaumont, Tex. to Norris City, Ill., has been completed and the first gasoline slug, to clean the line, entered at Beaumont on Jan. 27 to be followed later by heating oil.

Operating at capacity, Little Big Inch might release about 12,000 tank cars, but due to the defective pipe, the number of cars released will not nearly approximate this figure. It is estimated that deliveries by the pipeline will be cut from 30-40,000 b/d, even with all necessary pumps in action. Although "theoretically" freeing as many as 10,000 tank cars, they will be snatched up so rapidly by other movements throughout the country, that the overall tank car picture will show little if any improvement.

Draft Plus Illness

Further complicating tank car operations has been the shortage of trained manpower, caused primarily by the draft of men into the armed forces, and aggravated by widespread illness during recent weeks. Turn-around efficiency has been lowered drastically while the obsolescence of cars has forced an increasing number into repair shops, where, in turn, the manpower shortage is serious.

First public pronouncement that the East Coast oil transportation system needed an immediate "shot-in-the-arm" came last week from ODT which said immediate steps were being taken to speed up movements.

ODT petroleum transport officials listed the following steps taken to attain greater utilization of oil transportation equipment:

1. A letter from ODT Director Eastman calling upon all oil company executives to resume, where it has been partially or wholly abandoned, "very prompt loading and unloading of tank cars and tank trucks 24 hours a day, every day in the week, including Sundays and holidays."

2. Co-operation with the automotive division of WPB in obtaining prompt release of new commercial motor vehicles.

3. Assignment, at ODT's request, of 21 ICC service agents and 40 Assn. of American Railroads representatives to give special attention to the movement of tank cars.

4. Reissuance by the Assn. of American Railroads of its order of a year ago requiring that oil traffic be given handling next to troop movements and other special war traffic.

"A critical situation exists in petroleum transportation which requires action by all concerned in it," wrote Mr. Eastman. "There has been a slowdown in the movement and handling of tank cars and tank trucks which has resulted in deliveries substantially below those of

Hint Price Boost for Regular If Premium is Discontinued

NPN News Bureau

WASHINGTON—OPA "has been thinking about" what it would do if premium grade gasoline were abolished, NPN learned this week. Thoughts lead in the direction of a higher price for "regular" to compensate for refiners' loss of income, it was indicated, though official policy has by no means been formulated.

Meanwhile OPA is keeping an eye on octane ratings under existing specifications. Data has been sought from state governments that conduct regular tests of gasoline quality. And OPA's division of standards has launched several tests of its own, picking up samples in several eastern and midwestern areas to make sure that gasolines are being held, within a reasonable tolerance, to the minimum octane numbers called for.

'Demand for Steel to Continue at Relatively High Rate,' Scrap Salvage Chairman Says in Letter to Industry

Following is the text of an open letter to industry from Robert W. Wolcott, president, Lukens Steel Co., chairman of the American Industries Salvage Committee:

There are many guesses and too many assumptions as to when this present war will be brought to a successful conclusion. However, it is axiomatic that with the type of war being waged today and with the further fact that battles are being waged at all corners of the earth, the demand for steel from this country will continue at a relatively high rate. With this demand for steel there will continue to exist a large demand for scrap and other raw materials.

There are many factors comprising a satisfactory continuous flow of scrap from its sources to the steel mills and foundries. The war has brought about a constriction of certain of these factors in the form of a shortage of manpower, transportation and collection.

The result of these constrictions has been a steady decline over the past year in the nation's inventory of carbon steel scrap. This in spite of an increase in the production of pig iron, the use of which, within limits, can be increased to replace any scrap deficiency. This decrease in the Nation's inventory position should and must be checked. The normal spring increase in inventory can not be expected as the difficulty in the lack of manpower, transportation and collection facilities which we are now experiencing will only be accentuated. It is also very doubtful due to changed conditions that a campaign to collect scrap to keep the furnaces operating, such as was so successful in late 1941, could be repeated.

The present situation is a definite challenge. We must plan for and act on a continuing program to hold the present inventory position. We dare not ever be faced with the spectacle of steel furnaces shut down for lack of material.

few months ago in the face of increasing demand.

"This slow-down has resulted in a serious and still growing shortage of tank cars and tank trucks which must be corrected by increasing operating efficiency of shippers, carriers and receivers.

"It has been due to a variety of causes with which you are no doubt familiar. My office has been diligently working to improve operating conditions on the railroads and highways—in stimulating the road haul and terminal handling which results in the more rapid turnaround of equipment, and in providing much needed repair and tires for tank trucks as well as replacement units, in so far as they can be made available."

However, in one particular at least, Mr. Eastman was merely whistling in the dark. When he mentioned ODT's providing repair parts, tires and replacement units for tank truck operators, he forgot to say that these are practically non-existent. In fact, so serious have these shortages become that the Army, upon whom ODT's tank truck section had been depending for help, is itself critically short of parts, tires and new units. Its own shortages are in some instances so cramping military operations that some Army authorities have requested help from ODT. Here are two examples:

One midwestern Army airfield was so much in need of some repair parts that ODT asked if it could not scare them up—somewhere, or anywhere. They finally were found at a point along the East Coast and were sent—all 250 pounds of them—under special priority by plane.

Second example is the case of a Pacific Coast Army airfield which found itself in immediate need of 20 additional petroleum transports. Transportation officials finally gathered together about three-fourths of that number and earmarked them for the airfield. But, before they could be railroaded westward, they were placed on shipboard and sent overseas. Again the scramble was on to dig up the needed transports, but at latest count only five had been found.

Only Drop in Bucket

It is true, as Mr. Eastman said, that WPB's automotive division has co-operated in allocating some new heavy duty power units to petroleum transporters but the number so far is woefully inadequate, totaling only 105, "a mere drop in the bucket" according to informed sources.

There is as yet no "priority" control over the various shipments handled by tank trucks, that is to Army, Navy, Lend-Lease, Maritime Commission, civilian, etc. and this has proved a stumbling block in attempts to have transports utilized where they are most needed. If a petroleum tank trucker has demands twice over the capacity of his units, he will naturally handle first the more profitable runs and let the others wait. Further deterioration of tank trucks may force such control by ODT, but, as is well known, ODT Director Eastman prefers to count on voluntary co-operation than a "big stick."

In addition, there has as yet been no concrete action on establishment of an "essentiality" system by which the "must" truck operators—conspicuously, petroleum transporters—will be assured an adequate share of the parts, tires and new units which will be rolling from the assembly lines during 1944.

Inventories Adequate

This issue has been vociferously discussed for weeks, but some officials are loath to take the plunge feeling that the country's essential motor carriers will squeeze through some way, somehow. Others, however, predict the nation's petroleum transports, with hundreds of thousands of miles already under their belts, will collapse like the one-horse shay unless some such drastic action as an essentiality system is set up immediately.

Although many of the transportation problems are only temporary and will be solved more or less automatically, according to PAW Ickes, "we have got to solve them now—today." For the moment, he said, inventories are adequate in "most places" along the East Coast but unfortunately inventories are not large enough to carry through to Spring.

"Every oil man, railroad man, barge man, and everyone else who has anything to do with the transportation of petroleum," Mr. Ickes added, "is urged to save every minute in the operation of the facilities with which he is concerned. We cannot interfere with military movements, and we have got to get every ounce of work out of the facilities that are left us to use."

It was made clear to what extent the East is now dependent upon hand-to-mouth petroleum shipments when Deputy PAW Davies said:

"If we could have built up large terminal and bulk plant inventories on the East Coast, these would have cushioned the effect of the many transportation interruptions which now face us. Unfortunately, the grave over-all shortage of petroleum has made it impossible to do this, and inventories cannot stand the tremendous winter drains without better transportation. We are far too uncomfortably dependent upon day-to-day shipments whose arrival is subject to all sorts of factors."

The increased and "unforeseen" military movement, which has affected both overland and tanker movements to a degree which cannot be revealed is the most important cause of the current difficulty, Mr. Ickes pointed out.

Despite the seriousness of the situation, however, Davies said PAW was still hopeful of squeezing through the winter somehow.

"We are not announcing or predicting reduction in civilian supplies for the East Coast," he said, "nor will we until there is no other recourse. There may be, and probably will be, brief local shortages at points up and down the Atlantic Coast from time to time, but everything humanly possible is being done to solve these problems. . ."

Takes Middle Path

OPA officials are likewise loath to start a hysterical run on service stations by predicting any cut in gasoline coupon values in the near future.

Back in town after a two-weeks' trip was Col. Bryan Houston, OPA deputy administrator in charge of rationing,

treading the middle path closely with this statement to NPN:

"I have not heard of any prospect of shortage in supply, either in gasoline or in fuel oil. That doesn't mean that there isn't any; just that I have not been informed."

Although gasoline consumption is now running neck and neck with allocations, Col. Houston said the picture was "not encouraging," as "this is our best time of year to build up a little cushion." To discourage increased civilian gasoline use, he added, local ration boards were being repeatedly told to tighten coupon issuance.

From another high OPA rationing official came a similar non-committal statement on the situation. OPA, he said, has "no information" pointing to a supply problem in gasoline except on the West Coast and the only indication that there might be a problem in the East is the latest PAW supply bulletin in which the stock figures "don't look bad . . . but Ickes' remarks are pessimistic."

The OPA official said "anything" could happen on the West Coast, adding that local ration boards had been instructed to squeeze 5000 gal. out of "E" and "R" (off-highway) gasoline coupons. West Coast consumption, he stated, is now below the PAW allocation of 135,000 b/d; OPA consumption figure is 130,000 b/d and PAW's (which includes gasoline sold to the military at the retail level and not included in OPA's figure) is about 134,000 b/d.

OPA Chief Chester Bowles came the closest of the three OPA officials to a prediction of lower value coupons sometime in the future when he said, in a radio broadcast late last week:

"Every available gallon of oil has been carefully earmarked for a specific wartime use. There is not a drop of gasoline to spare for careless or unnecessary driving by any of us. There is always the possibility that rations may have to be reduced in some areas as the tempo of war increases."

It is certainly correct to say that the coming invasion of Europe will mean an increase in the tempo of the war.

As for fuel oil, Mr. Bowles warned that the civilian supply is "barely sufficient" to meet requirements of the basic rations. And again, he urged fuel oil consumers to watch their budgets, warning that with winter only half gone, they should have used no more than half of their rations to date. "If you're over that mark," he added, "cut down *now*, before you run into serious difficulties."

DPC-Sun Contract Increased

NPN News Bureau

WASHINGTON—Defense Plant Corp. has authorized an increase in its contract with Sun Oil Co. to provide additional equipment at Toledo, Ohio, at a cost of approximately $950,000, resulting in an over-all commitment of approximately $7,300,000. Sun will operate the facilities, title remaining in DPC.

Tire Problem Is Worst Ever, Houston Says, Explaining New Rules

NPN News Bureau

WASHINGTON — Problem of distributing fairly the decreasing quotas of passenger car tires available for rationing has reached the most difficult point of the war, according to OPA Rationing Chief Bryan Houston.

"At least I hope so," Col. Houston told a press conference this week. "I'd hate to think it could get any worse."

Col. Houston was explaining a drastic revision of tire rationing rules, effective Feb. 1, under which the few new tires available will be distributed on an "occupational" instead of a "mileage" basis.

The change is necessary, Col. Houston explained, because there are no longer enough Grade III tires—used tires and tires made of reclaimed rubber, formerly handed out to drivers whose mileage amounted to less than 601 miles a month—to take care of the needs of this class of driver. Yet some drivers whose requirements are under 601 miles a month are nevertheless highly essential. For example, a physician might be a "B" card driver so far as mileage was concerned, yet the community could not do without his services. This kind of driver must be kept in operation, even at the expense of less important operators driving high mileages.

Therefore what Grade I (new) tires there are—and there are less of these than there have been, too—will no longer be given only to operators driving high mileages. Instead, anyone who drives his car in connection with an occupation that would entitle him to preferred mileage if he needed it may apply for a ration certificate good for buying a Grade I tire. If such a tire is not available, he may obtain a certificate for a Grade III tire. The remaining supply of Grade III tires will go to persons whose occupational driving is less essential. Non-occupational drivers will be eligible only for recaps.

"We are changing from a rationing plan under which everyone who needed it could get some sort of a tire, to one where only some people can get tires," Col. Houston explained.

A guide to local ration boards in determining which motorists will get tires is provided by a list of "essential" uses which entitle a driver to consideration for Grade I tires. These uses are not listed in order of importance, however. Within the limits of the list, and of the tire quota assigned to it, each board must exercise discretion as to which are the most essential drivers in its community.

"There is no way that function can be performed except by the local board," Col. Houston said. "You cannot administer from Washington anything that so drastically affects the lives of the people of the community except in the community itself."

Classifications Listed

This list of classifications includes:

Transportation of workers to, from, or within essential establishments.

Construction, repair, and maintenance workers—in performance of occupation.

Farmers transporting farm products and supplies.

Transportation of farm workers, fishermen, seamen, marine workers, radio broadcast engineers and technicians.

Transportation of persons engaged in recruiting or training workers; maintaining industrial relations.

Delivery of U. S. mail.

Wholesale delivery of newspapers and magazines.

Licensed physician, surgeon, dentist, osteopath, chiropractor.

Official travel of government officers or employees—home-to-work travel is not official.

Persons transporting groups (four or more) of students, teachers, or school employees—travel to or from regular place of study.

School teachers or school officials—performance of school duties must require regular travel to more than one educational institution.

Midwife, veterinarian, public health nurse, or embalmer—in performance of professional duties.

Ministers and religious practitioners—in performance of religious duties.

Members of armed forces on authorized travel.

Full-time social workers—in performance of duties.

Volunteer firemen, Red Cross, member of ration board, selective service board, U. S. Defense Corps, etc.—for travel on official business only.

Transportation of non-portable photographic equipment—must be by a person regularly engaged in such activity.

Developments in supply which made this new departure necessary are summarized by Col. Houston as follows:

In 1941, 54,000,000 new tires were sold in the United States. In 1942, under a very tight rationing system,

OPA Rules on Dealers' Duty Toward Bogus Coupons

NPN News Bureau

WASHINGTON — Responsibility under OPA rationing regulations for handling counterfeit coupons was clarified Feb. 1 by an amendment to General Ration Order No. 8.

As defined by this amendment, (No. 5), "acquiring, using, transferring or holding" a counterfeit ration document is a violation of the regulations in itself (over and above the loss of gallonage represented by it) under either of two specific conditions. These are: (1) if the coupon is received or transferred under circumstances that would be in violation of the regulations even if the coupons were genuine; or (2) if the dealer knows or has reason to believe that it is a counterfeit.

This means that if a consumer or dealer buys or sells coupons, or a dealer accepts "R" coupons from a passenger car, the fact that the coupons turn out to be clever counterfeits which only an expert could recognize will not constitute a defense. But if there was no other violation of the rationing rules, a man will be held in violation for taking counterfeits only if he knew they were counterfeits, or if their spurious character is so obvious that he should have been able to recognize it.

only 1,500,000 were distributed, but we had good rubber on the roads.

By 1943 the tires on the road were wearing out. Meanwhile, on Dec. 1, 1942, the mileage rationing program was started. Under that program, every motorist was eligible for some type of tire, based on his monthly mileage allowance. There were three types available—Grade I, first quality new tires made of pre-war rubber, which went to drivers with the highest gasoline allowance; Grade II, lower quality new pre-war tires, going to the next highest mileage group; and Group III, used tires or new "war" tires of reclaimed rubber.

Grade II Tires Vanish

By May, 1943, Grade II tires had practically disappeared; the few that remained were put into Grade I. By July, stocks of all tires were so far depleted that eligibility for Grade III tires had to be restricted to drivers using their cars for occupational purposes.

During 1943, Col. Houston recalled, about 22,500,000 tires of all kinds were distributed, an average quota of almost 2 million tires a month. This total included 11,400,000 new tires, and 11,100,000 used tires.

Now there are only about a million and a half used tires remaining in dealers' hands for rationing. Tire quotas for February distribution, just established by the Office of Rubber Director, are 645,050 Grade I tires and the same number of Grade III. Additional reserve stocks to meet emergency needs bring February quotas to 750,000.

The quota of Grade I tires is only 295 less than last month, but the Grade III quota represents a cut of 184,375 from January. Grade III tires have recently been rationed at the rate of about 850,000 a month, and the present cut means that all the cars formerly dependent on these used tires can no longer be taken care of in this way.

Other February quotas set by Rubber Director's Office include truck tire quota of 267,917, reduced 8,712 from January's quota of 276,629. February quota of farm tractor and implement tires is 27,600, exactly the same as last month.

Dean Warns Against Early Use Of Period 4, 5 Coupons

NPN News Bureau

WASHINGTON—OPA Fuel Ration Director Joel Dean, denying rumors that Period 4 and 5 fuel oil coupons will be validated for use before Feb. 8, warned distributors against accepting these coupons on the strength of such rumors.

The only cases in which Period 4 and 5 coupons may be used before Feb. 8, Mr. Dean said, are cases in which consumers have not enough valid coupons on hand to cover the minimum drop required by their suppliers. Such consum-

(*Continued on p.* 38)

Refinery Prices Spelled Out for New Group In Midwest on Shipments to East Coast

NPN News Bureau

WASHINGTON—Uniform f.o.b. refinery prices for overland shipments of petroleum products from inland refineries to the East Coast were spelled out for a new group of midwestern refiners this week.

New schedules of maximum prices for refiners in Michigan on shipments to District 1, and for refiners in Ohio and parts of Indiana and Kentucky on shipments to District 1 and to Michigan, become effective Feb. 4 under Amendment 154 to Revised Price Schedule 88.

Program of establishing specific maximum prices for movements of this type was undertaken to eliminate confusion resulting from the multitude of individual ceilings under which inland refiners were operating on their East Coast sales. As refiners in the Mid-Continent and Midwest did not generally ship their products east during the base period, when this movement was compelled by the breakdown of tanker transportation each refiner took as his maximum price the "freeze" price on sales to some other destination. These individually-interpreted "ceilings" varied widely; they were confusing to East Coast buyers and to the Defense Supplies Corp. in calculating compensation for "excess products cost" under its compensatory adjustment plan.

The idea of replacing these inconsistent "freeze" ceilings with uniform, "structural" price schedules, area by area, was first tried out in inland Texas and the Shreveport-El Dorado area. While OPA's proposed ceiling structure for these refiners was being examined and amended by the refiners concerned, another set of ceiling schedules was proposed for certain midwestern areas. The latter became effective Nov. 15, the former, Dec. 1 (*see NPN, Nov.* 10, *p.* 24, *and Dec.* 8, *p.* 26).

The present schedule was first proposed late in November, when a tentative list of prices was mailed to refiners in these areas for criticism and comment. Meetings and discussions have been held, in Washington and in the field, and some revisions have been made.

Prices as they now stand are considered to reflect the general level of refinery net-backs received by refiners on sales in their normal marketing areas during the base period.

Prices for shipments from Ohio to Michigan are included in the spell-out, as this movement also is an abnormal one for which no prices existed in the base period.

Text of new schedule for Ohio, Indiana and Kentucky:

Maximum prices* in bulk lots loaded into transportation facilities f.o.b. shipping points in areas designated below for shipment to ultimate destinations in P.A.W. District One and Michigan.

(Cents per gallon)

Gasoline	Price area G	Price area I	Price area J-1	Price area K-1
80-82 Oct. A.S.T.M. and ethyl grade	8.375	8.625	8.75	8.75
72-74 Oct. ASTM	7.375	7.625	7.75	7.75
Kerosine and distillate fuel oils				
41 A.P.I. gravity and above W. W. kerosine	5.5	6.125	6.25	6.25
No. 1 P. W. distillate (fuel oil) range and stove oil and No. 1 fuel oils	5.375	‡5.625	5.75	‡6.125
No. 2 fuel oil	5.25	‡5.50	5.50	‡6.00
No. 3 fuel oil	5.125	5.50	5.50	‡6.00

*Sellers of No. 1 P. W. Distillate, range oil and No. 1 fuel oil shipping from Price Area J-1 for destinations other than PAW District I and Michigan are permitted by this amendment to use either the price listed herein, or a price permitted under other provisions of this price schedule.

‡For Boyd County Kentucky add .125.

‡For Stark County Ohio deduct .25.

Price Area G comprises the counties of Union, Henderson, Davies, Hancock, Breckinridge, Meade, Hardin, Bullitt, Jefferson, and Oldham in Kentucky; and the counties of Posey, Vanderburgh, Warrick, Spencer, Perry, Crawford, Harrison, Floyd and Clark in Indiana.

Price Area I comprises the area within a radius of 25 miles of Indianapolis, Indiana, the counties of Hamilton, Clermont, Brown, Adams, Scioto, Lawrence, Gallia, and Meigs in Ohio; and the counties of Boone, Kenton, Campbell, Pendleton, Bracken, Mason, Lewis, Greenup, and Boyd in Kentucky.

Price Area J-1 comprises the counties of Allen, Hancock, Lucas, Putnam, Wood, and Licking in Ohio.

Price Area K-1 comprises the counties of Cuyahoga, Lorain, Medina, Summit, Stark, Portage, Geauga, Lake, Ashtabula, Trumbull, Mahoning and Columbiana in Ohio.

New ceilings for Michigan:

Maximum prices in bulk lots loaded into transportation facilities f.o.b. shipping points in areas designated below for shipment of ultimate destinations in P.A.W. District One

(Cents per gallon)

Gasoline	Price area J-2	Price area H-2
80-82 Oct. ASTM and ethyl grade	9.0	8.75
72-74 Oct. ASTM	8.0	7.75
67-69 Oct. ASTM	7.25	7.00
Straight Run	6.00	6.00
Kerosine and distillate fuel oils		
46-49 A.P.I. gravity W.W. kerosine	6.25	6.0
41-45 A.P.I. gravity W.W. kerosine	6.00	5.75
No. 1 P. W. distillate (fuel oil)	5.75	5.50
No. 2 fuel oil	5.50	5.25
No. 3 fuel oil	5.25	5.00

Range or stove oils (range or stove oil shall take the maximum price of the product listed above of the same specifications).

Price Area J-2 comprises Wayne and Monroe Counties in Michigan.

Price Area H-2 comprises the State of Michigan (excluding Wayne and Monroe Counties).

PIPELINES—*Views of the Industry's Problems a*

Washington— *Hull May Rescue Foreign Oil from Present Chaos* —By Herbert Yocom

WASHINGTON — The indescribable confusion surrounding the attempted formulation of a foreign oil policy has now reached the point where only by some drastic action, such as centralizing controls publicly and irrevocably in the hands of the State Department, can the Administration hope to restore things to some semblance of an even keel.

Mr. Yocom

As this was being written, there were increasing indications that at least some in the Administration (meaning principally the president) have come to this very conclusion, with the result that there may be an early move in this direction—perhaps even before this issue of NPN is in the mails.

Pending such a move, however, reports that Secretary of State Hull either has been or is about to be given final say serve only to heighten the mystery as to who really is carrying the foreign oil ball.

If it isn't the distinguished secretary of state, is it Secretary of the Interior Ickes? Ten days ago he told NPN that he was "still running the oil show" and since that time he has presided over at least two meetings of the board of directors of PRC.

If neither Mr. Hull nor Mr. Ickes, is it Harry Hopkins, as some congressmen say and as to which there is no doubt in the minds of many for the reason that he plays a back-stage part in so many things hereabouts?

Also, where does War Mobilizer Byrnes fit into the picture?

These are questions that oil men in town this week for the monthly meeting of P.I.W.C. are asking. If they don't get the answer within the next day or two—as they well may—then the hearings soon to be held by a subcommittee of the Senate Interstate Commerce Committee on the Moore-Brewster PRC resolution can serve the useful purpose of settling the matter once and for all.

By every sign, the critical period in East Coast supply will be the end of February and early March. Increased military takings, failure of tanker shipments to come up to expectations, and general transportation difficulties, including the long delay in completing the 20-in. products line, have jointly contributed to the making of a situation which PAW Ickes describes as being "precarious", even now.

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Ickes Files Report

From Secretary Ickes' letter transmitting to President Roosevelt the annual report of the Department of the Interior for the last fiscal year: "We also continued to prepare for the day, only decades—not centuries—in the distance, when our liquid fuel reserves will be depleted to dangerously low levels. To cushion the shock of that inevitable occurrence, we furthered our experiments in extracting liquid fuels from coal and oil shales which are abundant:" . . . Geological survey section of the Ickes' report notes that federally supervised oil and gas properties currently contain about 7 per cent of known U.S. oil reserves and yield about 5 per cent of annual crude production.

It adds that "enhanced consultive activity and accelerated individual field studies and investigations particularly those dealing with secondary recovery methods, all designed to augment the contribution of federally supervised oil and gas resources to the war program, may reasonably be expected to increase those percentages during the ensuing few years." . . . Number of oil and gas properties under supervision on public lands last June 30 aggregated 4472, involving 2,819,314 acres in 19 states and Alaska. . . . Total of 4221 leaseholds in eight states, containing 7522 wells of which 4036 were productive of oil or gas, were under supervision on Indian lands.

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Spring Fashion Note

Best remark of the week: "We got his (Standard Oil of California's) shirt on the first contract. We'll get his shirt, coat and pants on the contract now proposed."—Rear Admiral H. A. Stuart, Director of Naval Petroleum Reserves, testifying before the House Public Lands Committee on Navy's contract dealings with Standard over the Elk Hills Reserve.

Atlantic Coast— *Oil Industry Seeks End of Long Tie-Up of Statistics* —By Henry Ozanne

NEW YORK — Many industry leaders deem this a favorable time to end the secrecy which for more than two years has prevented publication to the petroleum industry of certain essential statistical industrial data. The occasion is the recently announced relaxation in publication policy by WPB Chairman Nelson. Henceforth many industrial figures will be made available to nearly all industries, including data, past and present, on production and shipments, consumption, inventory, employment, materials and trends. Such figures in the interests of national safety, will not cover individual plant operations but merely industry lines and types of products.

Mr. Ozanne

The oil industry has been particularly victimized by the prevailing policy of "war restricted information", many of its statisticians feel. Many data which have been rigorously withheld from publication for the industry could not possibly benefit the enemy, oil men say, and as the industry's wartime position grows stronger there is even less excuse for such suppression.

This writer has seen piled high on the desks of industry executives documents bearing the curt "War Restricted Information" stamp. And he has browsed through report after report of this designation without finding one single sentence or figure which could possibly give aid, comfort or information to the Axis. Most industry leaders feel that the restriction policy is rather childish, since it supposes that all these reams of paper work mailed over the country could be kept out of the hands of foreign agents, if there were any who wanted to get hold of the information.

The "confidential" policy is dictated by the military which generally has no adequate working knowledge of the petroleum industry, and on some questions has proved itself totally ignorant. The procedure of marking any release "restricted" appears to have become a routine with both the Army and the Navy. It would seem that many reports get the "confidential" order without even a reading from a staff sergeant, judging by what is distributed under the stamp of censorship.

Until a short time ago the military was not even taking PAW into its confidence. It is not much of a secret any longer that one reason for the shortage of products last winter in the East was the way the military withheld its demands from PAW, presenting orders for products at the last minute without having allowed the industry any preparation. That anomaly of one war agency mistrusting the other largely has been corrected now, but the other anomaly remains—the war officials, apparently, still distrust the industry.

Dr. Frank M. Surface, chairman of the statistical subcommittee of the general committee of PAW Dist. 1, reports that present restrictions seriously hamper industrial operations. He agrees that off-shore movement data should be

restricted, but holds there is no excuse for not publishing figures on previous shipments. Sound demand estimates, he points out, can be based only on computations projected from past information.

He cites the S. and D. Committee's weekly tabulation, one of the most secret of all industrial data sheets, as an example of the hardships imposed by blanket censorship. This compilation details stocks, demands, movements, and with the exception of a single column of figures covering exports, could be made available to the industry, he feels, without military danger.

Dr. Robert E. Wilson, chairman of the strategic PIWC Standing Committee on Petroleum Economics, believes that in a 90-day period even figures on 100-octane production might safely be released. The theory of censorship, he indicates, is to protect a war program where that program is still weak. But as soon as schedules are fully attained, he says, the logic of restriction vanishes. From any common-sense psychology of warfare, the enemy is more demoralized by his knowledge of the strength of American production than by his ignorance of it.

There are some problems remaining, however, even under a no-censorship policy. One is: Should data be released in terms of absolute unit values, such as barrels, gallons, number of tank cars, etc., or in terms of percentages of a determined base? Percentage compilations, such as those in several API indices now, may mask the specific information needed. If percentages and indices are combined so as to include different orders of data, the resultant figure is wholly useless to the industry, but properly prepared percentage data are often more valuable than their component numerical data, especially in affording broad prospectives and revealing industry trends. Furthermore, the percentage form is more easily grasped by the public where a shortage, for instance, can always be appreciated in ratio to a normal supply. Absolute unit figures—gallons—because of their huge numerical size and lack of comparative presentation, can easily be misleading.

Another problem concerns the context in which any data are marshalled. Stocks and demand figures, for example, are much more significant in Dist. 1 than they are in Dist. 3 because of the factor of storage and "backup" due to transportation in the latter area.

Still another problem: If we concede the need for restriction on figures of military demand, then it is a choice of disclosing either total figures, including both civilian and military, or civilian alone. Any other presentation, by simple subtraction, would betray war orders. Which of the two possible forms of publication can best serve the industry?

All these detailed problems, however, are secondary to the policy question: Should not the oil industry have available much information that now is unreasonably kept from it? On that industry thinking is agreed in the affirmative. There is much buck-passing of blame: PAW says it is cramped by the military; OPA puts the responsibility on PAW; ODT says it is curbed by OWI.

Industry leaders say it is time to sit down with all these agencies and reach an agreement on what constitutes publishable industrial data and lift the scores of curbs by which the industry is hamstrung now.

Midwest— *Dist. 2 Refiners Build Hopes, Sighting New Sources of Crude* —By Earl Lamm

CHICAGO—Dist. 2 refiners are hopeful that their 200,000 b/d of idle refining capacity will soon be working instead of being extended to 300,000 b/d by the end of the year, as was estimated before the excess profits ban was lifted by DSC on shipments of West Texas crude. The prospective increase in unused capacity was due to estimated decline in Dist. 2 production.

Mr. Lamm

Fifty-two refiners whose 42 small, independent plants needed more crude went on the "mission to Washington," Paul Blazer, chairman of the Dist. 2 refining committee, said in his report to the industry.

While the foremost object of the trip was to secure relief from the discriminatory ban on compensatory adjustments to refiners in the excess tax profits brackets, extension of the extra cost freight reimbursements to include crudes in addition to those from West Texas, appears equally important. The refiners were given encouragement by Economic Stabilizer Vinson, and necessary figures are now being worked up, but are somewhat more complicated than those on West Texas, because they involve barge rates at some points. Some crude in storage near the oil fields also has gathering line charges against it. Any extension of the plan, of course, multiplies several-fold the lists of comparable freight rates, because of the more numerous points of origin.

But to speed up even the present movement of West Texas crude, tank cars must be made available and right now they are very tight. Completion of the 20-in. products pipeline, which is now starting an initial flow, is expected to help by releasing some cars. Availability of non-corrosion equipment for some refiners agreeable to running sour crude is also important. Time will be necessary to make the plant changes, but if sweet crudes are made available, refinery operations could be stepped up immediately.

The need for other crudes to supplement the West Texas supply was clearly shown in the written statements submitted to Judge Vinson by the group of refiners while in Washington. West Texas can supply only 75,000 b/d of crude under the compensatory plan, according to B. L. Majewski's statement to Judge Vinson, but Wyoming can add 20,000 b/d more, and other Texas regions, Louisiana, Mississippi, New Mexico and Arkansas another 125,000 b/d, or a total of 220,000 b/d. This, if made available, would fill the present 200,000 b/d idle refining capacity, but Dist. 2 production is declining and that additional 100,000 b/d of idle capacity by the end of the year, needs to be filled.

Cost of corrosion resistant refinery equipment, as given by John C. Day, secretary of Western Petroleum Refiners Assn., was four or five times more than the equipment used to run sweet crude.

Mr. Day also pointed out that Dist. 2 has 81 so-called independent refineries having an approximate rated crude oil capacity of 300,000 b/d, most of which are not constructed to run sour crudes at this time. Recent survey showed only 15 operators who stated they would run 37,000 b/d of sour crude if made available under the compensable plan, he said.

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What Price If Ethyl Goes?

Renewed emphasis is being placed on the prospect of Ethyl passing out of the picture for civilian use, that civilian motorists probably will soon have only one grade of gasoline.

Some time ago when the lead content of premium was reduced, OPA did not require a reduction in price.

It has been stated that OPA would increase the price of crude oil if it could be done without a corresponding increase in prices of products, which would add to the cost of living. "Holding the line" on living cost appears as OPA's objective.

Then, if and when Ethyl gasoline is discontinued for civilians, house brand should be stepped up into the Ethyl price bracket, the approximately 2c per gallon differential would allow room for a crude advance, including a wider margin for distributors and dealers to offset their loss of profits on Ethyl.

The Week's Orders

(Issued Jan. 22-29, 1944, inclusive)

OPA—Office of Price Administration

Prices

GMPR—SR 14, Am. 85—Rationed area rates on transportation of petroleum products

RPS 88, Am. 154—Uniform refinery prices in Dist. 2 on shipments to Dist. 1.

RPS 88, Order 18—Standard Oil Diesel prices at Paducah, Owensboro, Louisville

RMPR 137—Retail petroleum products ceilings

MPR 165, Supp. Serv. Reg. 26—Bunker fuel sold to foreign steamships

MPR 436, Am. 7—When contract prices determine crude ceilings

Rationing

RO 5C, Am. 95—Rations for moving new vehicles to distributing outlets

Am. 96—Boards' quotas on special rations

Am. 97—Bulk consumers' replenishment of losses

Am. 98—30 days for coupon surrender by large bulk consumers

Am. 99—Surrender of "R" coupons, Florida and Georgia

WPB—War Production Board

Orders

SO L-103-b, as am. 1-27-44—Glass container restrictions postponed

L-180, as am. 1-22-44—Battery production quota increased.

L-185, as am. 1-20-44—Water heater restrictions

L-211, Schedule 9 as am. 1-21-44—Oil country casing and tubing

M-81, Interp. 1—Can quota for packing

M-293, Table 14, as am. 1-22-44—Oil country boilers added to Plumbing and Heating table

Table 8, as am. 1-22-44—Boiler specifications table

P-98-b, Am. 1 to 10-19 version—Modification of petroleum production restrictions

SO U-1-a, as am. 1-22-44—Gas facilities for government agencies

SO U-1-h, as am. 1-22-44—Petroleum industry consumers permitted extension of facilities

REGULATIONS

CMP 1, Direction 45—M-293 takes precedence over CMP 1

Pri. Reg. 3, Interp. 9—MRO ratings under P-98-b

ODT—Office of Defense Transportation

GO ODT 3, Rev., Am. 6—Common carriers' joint action plans

AO ODT 9, Am. 1—Fleet record and report requirements

DSC—Defense Supplies Corporation

Reg. 5—Compensation for crude shipments from Dist. 3 to Dist. 2

Digest of Week's War-Oil Orders

Office of Price Administration

INCREASE IN CONTRACT CARRIERS' RATES FOR FUEL AND HEATING OIL CONSUMER DELIVERIES—GMPR, Rev. SR 14, Am. 85—Contract carriers throughout U. S. fuel oil rationing area may add .3c per gal. to their maximum price for delivery of fuel and heating oil to consumers, since they frequently collect and handle consumer's ration coupons, thus co-ordinating their ceiling with refiners' .3c additional permitted by RPS 88, Ams. 53 and 135, as well as MPR 165, Supp. Serv. Reg. 7, granting .3c additional to tank wagon commission sellers. Issued 1-24, effective 1-29.

CEILINGS SPELLED OUT FOR MORE MIDWEST REFINERIES—RPS 88, Am. 154 (See story in this issue.)

STANDARD OIL DIESEL CEILINGS — PADUCAH, OWENSBORO, LOUISVILLE, KY. — Order 18 under RPS 88—Pursuant to 8-31-43 application, f.o.b. terminal prices on Diesel fuel oil loaded into motor transport and tankcar, or bulk lots delivered into river equipment, set at 5c gal. Paducah, 5.125c Owensboro, and 5.25c Louisville. Issued 11-25-43.

RETAIL PETROLEUM PRODUCTS CEILINGS—RMPR 137—Substantially unchanged from MPR 137, but condensed and simplified. Greases sold at retail establishments now priced under 137. Simpler method provided for sellers computing ceilings by adding 3c to delivered cost or by adding 10-15-41 margin to delivered cost, namely: 3c margin is added to tank wagon ceiling of reference seller for undivided dealers at point where station is located. Or dealer may add to reference seller's present ceiling the difference between his 10-15-41 service station price and the reference seller's 10-15-41 tank wagon price. Liquefied petroleum gas sold as motor fuel not permitted the 3c margin allowance. Issued 1-28, effective 2-3.

CEILINGS ON SALES COMMISSIONS ON BUNKER FUEL SOLD TO FOREIGN STEAMSHIPS—MPR 165, Supp. Serv. Reg. 26—15c per net ton is ceiling on commission to any agent in the U. S. which suppliers at Atlantic and Pacific ports may pay, and 20c on Gulf of Mexico ports. Suppliers' ceilings under MPR 189 may not be increased to compensate them for such commission payment. Issued 1-25, effective 1-31.

CRUDE CEILINGS AS DETERMINED BY CONTRACT PRICES—MPR 436, Am. 7—Where deliveries were made before or within 60 days after 10-1-41 at a price exceeding the posted price, in accordance with a contract in effect on 10-1-41, then price actually charged on 10-1-41 or on first delivery after that date shall be ceiling for crude covered by the contract. Issued 1-24, effective 1-29.

RATIONS FOR MOVING NEW VEHICLES TO DISTRIBUTING OUTLETS—RO 5C, Am. 95—Rations permitted for moving new commercial motor vehicles from factory to distributing outlet, or between such outlets, if Certificate of War Necessity not legally required. Issued 1-29, effective 2-3.

QUOTAS ON SPECIAL RATIONS—RO 5C, Am. 96—Non-occupational rations issued to prevent undue hardship are subject to quota assigned each Board by Washington OPA. A board's refusal of such rations not subject to appeal. Issued 1-29, effective 2-1.

BULK CONSUMERS' REPLENISHMENT OF LOSSES—RO 5C, Am. 97—Application for replenishment of storage losses may be made to issuing Board or to Board governing area in which storage facilities are located. Ration evidences or deposit certificate may be issued at discretion of Board; if by area Board, originally-issuing Board must be notified. Issued 1-29, effective 2-3.

30-DAY LEEWAY FOR COUPON-SURRENDER BY LARGE BULK CONSUMERS—RO 5C, Am. 98—Establishments belonging to group of 25 or more served by single ration bank account may receive gasoline transfers on a delayed coupon-surrender basis. Transferor must record date, place, amount of delivery, recipient. Coupons therefor must be forwarded within 30 days, and transferor must note date of receipt on invoice. Issued 1-29, effective 2-3.

R COUPON SURRENDER IN FLORIDA AND GEORGIA—RO 5C, Am. 99—Valid R coupons (non-highway ration) may be surrendered to issuing Board in Florida and Georgia for equivalent Class E coupons. Transferors may honor R coupons only for delivery of gasoline into motorboat fuel tanks or for delivery by tank wagon, tank truck, or portable drums to places selected by transferees holding non-highway rations. Dealers not maintaining such delivery facilities must turn in by 2-10-44 all R coupons already in their possession, on separate gummed sheets summarized as of close of business on 1-31-44, and licensed distributors lacking these facilities must deposit them in ration bank accounts by 2-10. Issued 1-20, effective 2-1.

War Production Board

GLASS CONTAINER RESTRICTIONS — L-103-b, as am. 1-27-44—Prohibition of packer's acceptance of glass containers for packing products not listed in any L-103-b schedule postponed to 3-1-44. Waste included in list of permitted materials for crown caps. Commercial users using glass containers at more than one plant may apply separate quotas for each plant, or group of plants, or a collective quota for all such plants. Any parent corporation having one or more wholly owned subsidiaries may consider itself a single commercial user for this purpose. Issued 1-27.

INCREASE IN BATTERY PRODUCTION QUOTA—L-180, as am. 1-22-44.—Additional 10%, instead of former 5% production of batteries authorized for 1944, based on total sales for 1941 or 1943, whichever is higher, but plants in Group I Labor Market Areas denied this increase in production, and limited to 100% of 1941 or 1943. Producers not in Group I or II Labor Market Areas may, upon application, be granted quota increase by nearest WPB Field Office. Quarterly reports of shipments still required. Issued 1-22.

WATER HEATER RESTRICTIONS—L-185, as am. 1-20-44—Metal jackets permitted for direct-fired water heaters using fuel oil as fuel. Copper repair and replacement parts permitted, if replacing copper parts of equal weight (to within 1 lb.). Production quotas on direct-fired water heaters: (1941 base) underfired 65%, coal and wood-fired 70%, side-arm heaters and waterbacks 70%, all others 30%; indirect water heaters 20%. Issued 1-20.

OIL COUNTRY CASING AND TUBING—L-211, Schedule 9 as am. 1-21—Seamless and electric weld casing specified in Grade J-55 table of permitted sizes, and seamless and electric weld tubing in tubing table. Issued 1-21.

PACKING QUOTAS—M-81, Interp. 1—Deduction of glass container pack computed thus: Convert area of packing quota plate (base boxes) to gallonage or pounds of product which may be packed in largest listed size; deduct gallonage or pounds packed in glass; convert gallonage or pounds remaining to area of plate based on largest listed size, which is metal can quota. Item 55 of Schedule III — leather polishes, waxes, etc.—requires only paste products packed in glass in 1944 to be deducted. Issued 1-24.

OIL COUNTRY BOILERS—M-293, Table 14—Oil country boilers listed as an X product in new section added to Plumbing & Heating Division table of General Scheduling Order. Issued 1-22.

BOILER SPECIFICATIONS—M-293, Table 8—Oil country boilers designated as an X product in conformity with new listing in Table 14, see above. Issued 1-22.

PETROLEUM PRODUCTION ORDER REVISION—P-98-b, Am. 1 to 10-19-43 version—

(*Continued on p. 40*)

These digests of orders, amendments and interpretations are written with care and judgment for the purpose of giving the reader a reasonable idea of the character and extent of this material, but the publisher does not warrant their completeness or absolute technical or legal accuracy. Important decisions should be made only after due study of the complete text, which the Oil-LAW-Gram can furnish.

NPN will appreciate hearing from its readers if they feel any pertinent regulations have been omitted from this page.

Copies of the complete text of the following orders can be obtained from PLATT'S OIL-Law-GRAM, 1213 W. Third St., Cleveland, Ohio.

Minimum charge for single copies, $1, postage paid. One year's service, $100.

CODE: AO—Administrative Order; CMP—Controlled Materials Plan; D—Directive; FDO—Food Distribution Order; GMPR—General Maximum Price Regulation; GO—General Order; Interp.—Interpretation; L—Limitation Order; M—Conservation Order; MPR—Maximum Price Regulation; P—Preference Rating Order; PAO—Petroleum Administrative Order; Pri. Reg.—Priorities Regulation; Proc. Reg.—Procedural Regulation; PS—Price Schedule; RO—Ration Order; RPS—Revised Price Schedule; SO—Supplementary Order; SR—Supplementary Regulation.

The Editor's Page

Summer Weather Aids War Effort As Western Oil Men Fight Diminishing Crude and Manpower Supply

TULSA, Okla.—This fine, summery clear weather down here since "the big snow" of some weeks back, only emphasizes the co-operation of a Providence all over the country in our war effort. In the crucial winter of the last war, the U.S. and its Allies were blessed by a most "open" winter that expedited the movement of the vast volume of war freight and which, undoubtedly, was an important factor in having enough supplies in France so that the "big push" of that summer and fall ended in November with victory.

This country out here is quite transportation conscious these days because of the long hauls of its food products and particularly the long hauls by rail and pipeline of its oil. When transportation gets tied up with extreme cold and snow all over the country and especially in the East, this country knows it for shipments pile up at transfer points and tank cars just don't come back home.

There is a shortage of transportation facilities out here especially for oil. Tank cars have been transferred from through eastern service even to alleviating the extreme oil shortages on the west coast. Truck transports are running out of parts and tires and manpower. But Providence seems to be giving hearty support to the preparation for the "big invasion" of this war, by providing the best sort of transportation weather both here in Oklahoma and Kansas where the temperature was up to 68 last week and few wore coats, to all of the North, Central and East through which the war supplies from the West must move.

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Oil Men Ask Vinson: Which is "Indefensible" —Fighting the War or Aiding Roosevelt?

WHILE PROVIDENCE is supplying the best of transportation weather to help the oil industry in its great war job, many of the high authorities at Washington and a few other places, are not giving the oil men any war assistance. The oil supply is short and getting shorter and along with it, draft boards, war manpower commissions, and war labor boards are not helping the oil industry in holding its essential personnel.

Getting more drilling done in this Midcontinent area may be said to be more important right now than new wells and fields most anywhere else, except on the Pacific Coast. More oil here means immediate utilization of some 200,000 b/d idle refining capacity and the supplying of oil products not only to the great food producing country but also to its many large centers of war manufacturing.

It is from here that the big effort comes for a price for crude oil that will invite more wildcat drilling. Also Oklahoma is the home of the man who has fought for such a bill through the House, Congressman Disney, and the home of the Senator who is hammering away in support of it in the Senate, Senator Thomas. It may truly be said the whole state is behind the Disney bill and its objectives.

Last week Economic Stabilizer Vinson wrote the Senate Banking and Currency Committee that the Disney bill is "indefensible" that it invites "grabs" from "all pressure groups" and that the President cannot carry out price stabilization if he is subjected to "piecemeal legislative inroads."

Vinson's statement raises blunt questions out here. Such as, Getting enough petroleum products to keep the ever increasing fighting machinery going 100%, or to let the success of the war be secondary but make it easy for Roosevelt to jockey with all the alleged "pressure groups"? And so Roosevelt can say to those groups, "Well, I have turned down the oil industry and you know how vital that is to the war?"

Since the Roosevelt administration has not made a move to find more oil, though warned by even its best friends for more than two years of a severe oil shortage, should oil men sit with closed mouths and let the shortage increase, let supplies become tragically insufficient for domestic essential war use and also for military use? Or should the oil industry do what it can to aid the military forces and our essential transportation with legislation which may be "piecemeal" but which is about all that is still available to the oil industry to invoke in behalf of a sufficient oil supply to win the war in the shortest possible time?

With every witness before the public testifying to a still greater shortage of oil, including more serious warnings the past week from PAW Ickes, OPA Chief Bowles and others, and with the industry making every effort to respond to the still greater demands of the military authorities, which is the more "indefensible", it is asked out here in the oil country, to get the oil needed for the war or to give first aid to the President's political predicament?

There are other questions asked, and answered, but not in such printable language.

Draft Boards Ignore Need of Oil Industry And Thus Reduce Needed War Supplies

THE OIL INDUSTRY'S war effort is being seriously crippled today by lack of manpower. Prospects are the situation will get much worse. The industry has been silent too long as to the job it is doing and as to its need for men. We have lost all the slack and from now on, lack of manpower means less barrels of oil.

That is actually the case that the members of the Western Petroleum Refiners Assn. are putting up to Washington these days. Refinery operations out here have slowed down in final output to the military forces for lack of enough men and of the right kind. This is at a time when the military is asking still more output of some products that call for the best of refinery men.

However the military forces seem to be still proselyting direct to the industry's skilled and technical men without going to PAW or, seemingly, giving thought to looking in their own forces for men already there and misplaced.

There are reports out here among refiners that they could produce sizeable increases of even that quintessence of all motor fuels, 100 octane aviation gasoline, if they had more men.

Refinery men are continuing to be lost to the draft, to the solicitations by the military departments and to other war industries that have been allowed to pay higher wages. Oil

READERS' comments and opinions will be much appreciated by Warren C. Platt, NPN's Editor and Publisher, Penton Building, Cleveland 13, Ohio.

industry wage scales in peace times, were so much above those of other industries, that they were the last to receive attention and they moved upward the least. So many draft and labor board and manpower commission officials have failed to see the oil industry in its true light as just as essential a war industry as those making planes and other war munitions, that the industry has received little protection of its manpower.

Refineries, engaged mostly in direct war work, are short even of clean-out men and other such skilled or semi-skilled labor with the result that it takes longer to do the maintenance work about a plant than it should and even longer to operate it.

Effort has been made to get men on the farms hereabouts who are not needed there all the time in the winter, but the draft boards say that if these farm hands take part time refinery war work they will be changed from their essential agricultural classification and be subject to the draft.

The democratic and local character of these draft boards keeps our seizing of citizens for military service from being tyranny but, unfortunately, not all draft board members see that there is more to this war than supplying men to just the Army and Navy. Too many members do not see the need for men in the civilian effort behind the lines. In a northern Kansas town the other day, it was told at the jobbers meeting at Wichita, one of the two remaining oil company truck drivers was called in the draft. The oil jobber tried to show the draft board that it took two truck drivers working long hours to take care of the town and the essential civilian needs, and that there were no more men who could be used as drivers. But the draft board was deaf to his pleas. The oil man said he is just going to let the town suffer.

Draft boards are also disregarding the safety element in refusing deferment to men in oil service. The hazard of putting men on valuable trucks hauling highly volatile liquids, who are below par mentally and physically, the danger of letting such men handle the multitude of valves and manifolds around a refinery or storage plant, does not impress too many of these draft board members.

The railroads are complaining of the same disregard to their needs. We probably will have to have more wrecks and more accidents on highway and in oil plants before some of these draft boards will wake up to the necessity of supplying competent manpower to the battle lines BACK HOME.

Are the Judges Helping to Keep These OPA Kangaroo Courts in Business?

SEVERAL federal district judges seem to be drawing one of those fine lines that mark distinctions but not differences for which lawyers are somewhat famous.

It seems that when an oil company, or station operator, is forbidden to receive or dispense any more gasoline or fuel oil after allegedly violating an OPA order, he is not being "punished for past conduct" but his error of judgment, if any, is simply being "remedied" in order "to protect the efficiency of rationing." One judge assures us that there is no taking of property or interference with personal liberty. And the court adds, "Nothing that is really his is taken from him. His private interest has merely come into collision with a public interest and has to yield."

The importance of the point above lies in that if the oil man is just having his methods remedied against the future, he can be thus "remedied" even to the complete destruction of his business and of his business career by order of an OPA hearing administrator, no matter who that administrator is, how little he is qualified to pass judgment, how faultily or ignorantly he has "tried the case" or even whether he speaks English or is an American citizen. OPA hearing administrators, at least up to the last copy of the regulations that we saw some weeks ago, do not have to be anyone at all, nor are they chosen according to any specifications nor passed on by any constitutional authority such as the U. S. Senate that passes on most other types of judges and administrators. In fact, an OPA hearing administrator could be the office boy, who might be asked to sit in and take the case while the designated hearing administrator goes to the baseball game. And if so, then, under OPA rules, the victim has no right to kick. That is why people have dubbed these OPA hearing administrators and their trials, kangaroo courts.

However, still according to the above judicial fine points, if one is being punished then these judges seem to be prepared to admit that one is entitled to his day in a constitutional court of law.

Laymen, we're sure, will be interested in knowing just exactly when taking away the business of a duly and legally established business man, following an alleged violation of law, ceased to be punishment in anyone's language?

And, if stopping a man from doing business isn't taking his business in ordinary law, then what is it?

Also if stopping a man from doing business is not interference with personal liberty, then what is it?

What is this thing we call business and who does it belong to? When a man, by hard work and fair dealing, gets people to buy from him regularly, and uses his own money to buy and sell the merchandise to carry on the business to pay the wages and expenses, then it has been our habit in this country to say that it is that man's business—meaning that he owns it. Congress has passed laws to protect business, as such, and to protect a man in carrying on that business and the courts have upheld those laws.

A federal judge now says that when an OPA kangaroo court stops that man from doing business, takes his business away from him, the OPA "court" is not taking anything that belongs to the merchant, but only that "his private interest has collided with the public interest". What is his private interest? Isn't it owning this thing we call business?

This sounds like a $64 Frankfurterized way of beating around the bush to get to a New Deal end—keeping OPA kangaroo courts intact. They say these courts operated under "administrative law" and not judicial law. The difference seems to be: when is a punishment not a punishment? When is a taking of property not a taking of property?

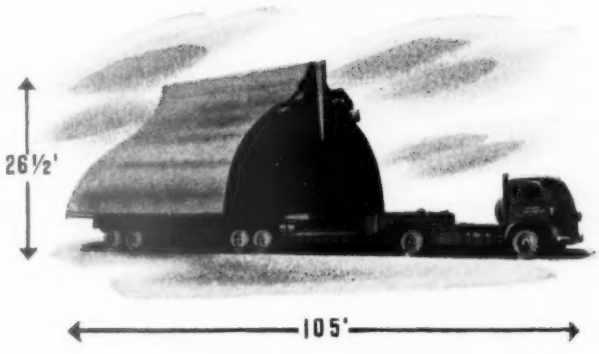
The answer seems to be when one's private interest collides with a public interest. So again you meet yourself coming around the barn the other way.

NPN, in contributing this discussion, is not trying to pass on the guilt or innocence of any oil company that has collided with a public interest. Maybe it has. But if so, then NPN cannot help believe that it is entitled to trial in a duly constituted court of law, under the usual rules of evidence and according to legal procedure. These judges seem to be just using words to keep these alleged law violators under the jurisdiction of the OPA kangaroo courts, and to continue those courts in operation.

Under its basic law OPA is required by Congress, and so far as we know it has followed the law, to take all alleged violations of its price orders to the duly constituted legal machinery of the federal courts; that is, to the district attorneys, to the grand juries or direct to the district judges themselves in open court.

Why, then, cannot OPA follow the same procedure as regards "collisions with a public interest" in rationing?

Is it because the OPAers write their own rules of procedure and evidence, select their own "judges" without regard to any qualifications or supervision by congress or the duly selected judges, in order to keep all the powers of prosecutor, judge and jury within their own control?



Down to the Sea in AUTOCARS!

Autocar Trucks on the home front, like Autocar Trucks at the fighting fronts, are doing heavy-duty work. Here, for example, California's Bigge Drayage Company hauls a 60-ton hull section of a prefabricated warship for Henry J. Kaiser. The truck and trailer assembly is 105 feet long. The hull section is 26½ feet high. And as the 38-wheeled combination moves along eight miles of city streets, telephone and electric-railway wires must be raised to let it pass. . . . In war or peace, Autocar is a famous name for heavy-duty work.

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MANUFACTURED IN ARDMORE, PA.

SERVICED BY FACTORY BRANCHES FROM COAST TO COAST

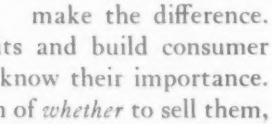
BUY WAR BONDS and keep the Bonds You Buy!

PENNSYLVANIA

OFFERS YOU AN OPPORTUNITY THAT KNOCKS *TWICE*

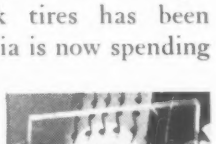
Yesterday's filling stations have become today's service stations. Tires, batteries, and other automotive accessories make the difference. They supplement profits and build consumer contacts. You oil men know their importance. It's no longer a question of *whether* to sell them, but *what* products, *what* brands, and *what* services to sell.

Here at Pennsylvania we have a detailed knowledge of oil industry problems. We have special personnel, prepared to give you complete advice regarding line selection, planning, merchandising, advertising, selling. We are large enough to assure prompt, substantial shipments to all areas, yet not too big to consider your requirements personally.



Moreover, in the Pennsylvania line you are offered—for retail or wholesale distribution, and for your own business vehicles—tires for *every* wartime need: the *finest* tires available for the money. This is the opportunity the Pennsylvania proposition offers you *today*.

When peace is signed, opportunity will knock a second time. During the war, Pennsylvania production of truck tires has been multiplied by 5. Pennsylvania is now spending another million and a half dollars on new plant and equipment.



Pennsylvania engineers have led in experimenting with all types of synthetics and with combinations of rubber and synthetic. They will be prepared in the postwar period to deliver the best tires producible from available materials, be they what they may.

And last but not least, Pennsylvania is ready to produce—as soon as Victory will permit—the new Pennsylvania Silent Vacuum Cup Tire—the first really different tire in a generation.

How about talking it over with Pennsylvania? Whether you're thinking about more profits now, or planning to insure your peacetime future, we're *doubly* ready to be of help. Address your inquiry to Pennsylvania Rubber Company, Jeannette, Pennsylvania.

PENNSYLVANIA TIRES

MANUFACTURED BY THE ORIGINATORS OF THE *Silent Vacuum Cup Tire*

Pennsylvania is one of several associated companies operating the Copolymer Corporation at Baton Rouge, La., the first plant to produce synthetic rubber for the United States Government.

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Discusses War and Postwar Challenge Facing Independent Jobber

Paul Kempf In Address to Kansas Assn. Suggests Co-operative Buying as Means of Meeting Stiffer Competition After War

By Paul R. Kempf

THE REPORT of the Joint Use of Marketing Facilities Subcommittee to the Marketing Committee for District 2 developed some startling statistics, and I quote these first as an established indication of the tremendous function performed by the independent distributor, both wholesale and retail, in this area.

District 2 comprises 15 states located in what is better known as the Mississippi Valley. In this great area are located vast and diversified manufacturing industries, including many gigantic war plants, large military establishments and training camps; tremendous mining and timber operations; and extensive agricultural areas which constitute the bread basket of the Nation.

There are 1348 counties in this area covering some 917,000 square miles, or 30% of the U. S. total area, with a population of 48,000,000, or 37% of the U. S. total. Here are 41% of the U. S. total passenger cars — amounting to 11,200,000 and 37% of the heavy trucks and buses totaling 1,700,000 and 1,200,000 tractors, which is 67% of the total.

The gasoline consumption in this area is 40% of the U.S. total.

65% of Independents

As of September, 1942, the petroleum industry had in operation in District 2 approximately 20,000 bulk plants—53% of the U.S. total—and doing business in this area were 7200 independent oil jobbers, which totals 65% of the independents of the entire country.

In this area, the great majority of the retail outlets are operated by independent dealers and a substantial percentage of the consumer business is delivered by commission drivers.

These independent jobbers and retailers who maintain such a vast network of petroleum distribution in this area are numerically strong but individually "small business". They have established an essential place for themselves in the American Way, by using the basic principles of individual initiative and private enterprise, which—prior to the war—were unhampered by manpower shortages, material scarcities, transportation difficulties and Government regulations.

As long as the war lasts, these problems will remain; and, for this reason, the outlook for the independent is serious.

Is 2-Phase Problem

Our desire to remain a postwar factor must be approached in two phases: first, the duration and, second, the postwar period.

In discussing the duration phase which will be concluded with Peace, it is well to observe the trends of 1943 and then make plans for the immediate future.

For the duration, independent oil men probably will have to look to Congress for relief from continually narrowing profit margins due to product stringency, manpower troubles, higher taxes and other war-borne ills. But when peace comes, co-operative buying should offer the thousands of independent jobbers in the Middle West and elsewhere their best chance for survival in a highly competitive era.

These were among conclusions drawn by Paul Kempf in an address to the Kansas Oil Men's Assn. which met in annual session Jan. 24-25 in Wichita. Mr. Kempf, of the Staebler-Kempf Co., Ann Arbor, Mich., is executive secretary of National Dixie Distributors, Inc., and a member of the Dist. 2 joint use of marketing facilities subcommittee and of the Dist. 2 petroleum jobbers subcommittee.

Mr. Kempf said that small businessmen should plan now for co-operative purchasing.

Pointing out that Dixie Distributors have saved its members "hundreds of thousands of dollars" through co-operative buying, he invited jobbers to join his organization, promised assistance in forming their own purchasing groups if they preferred.

Mr. Kempf offers a number of meaty suggestions that will give forward looking independent management something to think about, and his talk is printed herewith in full.

1—In reviewing the year of 1943, any member of this vast army of independent jobbers and retailers in District 2 will recognize the necessity of rationing petroleum products to the successful conclusion of the war and take pride in the fact that the mobile war equipment of this country has never failed to operate because of a lack of petroleum fuel.

Rationing, of course, is responsible for the shrinking volume of products available for civilians, and if we can believe present reports, further restrictions are likely and will add further hardships to the independents.

Such a condition of further reduction in volume does not affect the overall picture for the major oil companies which are fully integrated, thereby enjoying a good income from production, refining and transportation and an exclusive market covering the entire requirements of lend-lease, the Army and the Navy.

As opposed to this profitable position of the majors, the independents' income is confined solely to retail and consumer business and this reduced income must now cover increased clerical expense caused by rationing, increased taxes, increased labor costs, increased freight rates and the elimination of associated lines of products such as tires, batteries, accessories and antifreeze.

This situation represents an inequity in planning a sound war economy and, if allowed to persist, will eventually overtake the remarkable ingenuity of the small independents which, to date, has permitted them to maintain this vast distribution so essential to the war effort. Also a continuation of this economy will destroy competition, which is fundamental if individual initiative is to survive.

Wants No Subsidy

The independent of the petroleum industry does not ask for subsidies, bonuses or other schemes to correct this intolerable condition; he only asks for reasonable and compensatory prices. His first effort to obtain this adjustment was recently sacrificed when the jobber questionnaire was dismissed in favor of the "hold the line" order and this in spite of the fact that the general commodity index now is 117 while that of petroleum products is 60.

As regards reasonable margins, the independents of this country have exercised every patience. They have presented their problems in proper form and in great detail to the bureaucracies established for this purpose and originated by the War Emergency Act.

To date, the collectivists have won, but only at the expense of free enterprise and now, to preserve that greatest fundamental of the "American Way", our only recourse is through our Congressmen and Senators.

Again I repeat—we are numerically strong but individually weak and, therefore, our appeal through such groups as the K.O.M.A. and similar trade associations is our only opportunity for relief.

Manpower Problem Acute

2—Of equal importance, with reasonable margins, is the manpower necessary to carry on this essential enterprise of independent distribution.

The impact of war, of necessity, creates a scarcity of manpower, but the wartime solution of that problem has stopped with marketing and, therefore, thrown in jeopardy the existence of 105,000 retail outlets, the great majority of which are operated by independent dealers in District 2.

In the early part of 1943, the inroads of Selective Service and war industries on petroleum manpower were not too serious, but as the year advanced the constant drain into war industries and military service has left the petroleum industry in a precarious position.

A procedure for correcting this intolerable situation has been devised by the War Manpower Commission in con-

junction with ODT and PAW. This procedure calls for the declaration of any given labor shortage area as "locally needed".

No doubt you are all familiar with this procedure, so my remarks will be confined to that part which is a definite discrimination against the independent distributor.

The ruling requires that an appeal can only be made to the War Manpower Commission when "the majority of marketers in a given area are affected by the labor shortage".

The majors, because of the very nature and size of their organizations, employ more manpower to cover any operation than the independent and, therefore, as the drain on manpower progressed they were able to transfer men within their large organizations to other positions as they became vacant.

In contrast to this, the independent—because he is small—employs far less men to cover a given operation and, therefore, is unable to effect a transfer.

Stymies Independent

This situation places the independent in a position where he cannot avail himself of the relief described in the "locally needed" procedure because a majority of the distributors in his area will, in most cases, include the majors who, at this particular time, will not be pressed for manpower to the extent that they will join in an appeal.

Independents throughout the region find themselves in this manpower squeeze and are at this moment desperately seeking means to avoid closing their bulk plants and retail outlets; and realizing at the same time that such closings will seriously cripple the war effort because of failure to provide transportation and fuel, which is vital to the farmers, war workers and civilians.

Can it be that economic forces have been set up by the planners which do not take into consideration the necessity of this independent petroleum distribution and which, at the same time, destroy competition between large and small companies?

Here again the independents have been patient. The manpower situation has been placed before the planners and their committees but to date no relief is in sight.

The solution of this problem, as in obtaining reasonable margins, cannot rest with us as individuals, but rather with our state associations and similar groups who can present to our Congressmen and representatives a united front on the manpower needs of the independent.

Must Share Supply

3—Manpower needs and equitable margins are a factor only when there is an available supply of petroleum products.

A discussion of the big problem of supply must, of necessity, begin with crude which is basic to the manufacturing problem.

Quoting the year end statement of W. R. Boyd, Jr., president of the American Petroleum Institute and chairman of P.I.W.C. as it appeared in NATIONAL PETROLEUM NEWS—"The facts are simple and should be clearly understood by everyone who can not get the quantity or quality of gasoline or oil he would like. A year ago we had only about 1,700,000 men overseas, but by next July that number will have trebled to more than 5,000,000. Trebling our overseas army obviously trebles the requirements for fighting oils. Can our oil production be trebled or even doubled? Not a chance."

In the interests of the welfare of the Nation to which crude is most vital, the independent producer has for two years waged a fight for an increased price for crude oil. He has constantly prophesied the predicament in which our country now finds itself. This fight has continued throughout the regime of the "new deal",

Paul R. Kempf
"Isolation means annihilation"

and "hold the line", both of which represent a petroleum policy viewed by many as based on political expediency rather than on "win the war".

Urges Crude Increase

As you know, this fight has now been presented to Congress and the first sign of a healthy petroleum economy is reflected in the actions of the House. It is hoped that an informed Senate will take similar action.

The 35c per bbl. increase in crude oil price ceiling recommended by PAW will, to a large extent, reverse the declining trend in new reserve discoveries. It will stimulate exploratory operations and prevent premature abandonment of stripper wells. Combine this proposed increase with a release of necessary production equipment and in a short time we will exceed the 19,000 wells drilled in 1943 in known fields and materially assist in the search for new ones.

For the independent distributor, an adequate increase in the price of crude will assure him an available supply of the refined product. This domestic supply is vital to the farmer, war worker and civilian whose fuel requirements must be met to prevent a breakdown on the home front, which is the supply line for the fighting front, and neither of which can exist without the other.

Products Must Rise

In increasing the price of crude, the independent distributor must have a proportionate raise in the ceiling price of refined products to maintain a healthy economic position. A review of bill H.R. 2887 which was passed by the House of Representatives indicates that it does not compel the raising of refined products prices and, therefore, every independent distributor and state association is urged to contact immediately their Senator, requesting an amendment which will protect the independent distributors from any "squeeze" play as the result of a rise in crude oil prices.

It should further be stressed that regardless of the quantity of the refined product available, every independent distributor should receive his equitable share of that product. Without this, the existence of 7200 independent distributors in District 2 is in question and their vast network of distribution will break.

An equitable share of product for the independent can best be defined as that volume which will keep his retail stations functioning in the same manner and for the same duration as the major integrated unit.

Postwar Phase

4—A summary of the duration phase indicates major problems for the independent consisting of insufficient margins, shortage of manpower and an insufficient supply of products. These problems, which are the result of the impact of war, will remain with us to a great extent until the declaration of peace. The remedies suggested will ease the burden, but will not bring about complete relief.

You will note in my discussion of the duration phase a fear of certain trends which may be the result of a new economic thinking, either necessary to the successful conclusion of the war, or forced on us under the guise of a war necessity.

In the latter case, these trends of reform nature toward government control must be blocked by the planners of private competitive industry and, in their fight for private initiative and free competition, the larger companies —who are small in number and extremely vulnerable to Government control—should lend their utmost support to maintain the smaller unit; for only as the small competitor is maintained can the large company exist.

Few people in this industry want competition eliminated because most all recognize that complete Government control can never be realized unless the industry is reduced from over 7200 in-

(*Continued on p.* 31)

The amazing new

VEEDOL 90 SERIES OILS

are now available to commercial users

(IN EASTERN & MID-CONTINENT AREAS ONLY)

FRESH from the tough proving ground of the battlefield, Veedol 90 Series Oils now bring their great advantages to civilian commercial users.

These are heavy duty oils for automotive and stationary engines of both Diesel and electric ignition types. Having not only amazing detergency, or high dispersion characteristics, but great resistance to oxidation as well, Veedol 90 Series Oils represent *one of the most important lubrication developments in the history of the industry.*

VEEDOL 90 SERIES OILS WILL TEND TOWARD:

1. Preventing certain types of deposits from remaining in the engine, which may plug oil lines, stick rings and valves.
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4. Because these oils are made from 100% Pennsylvania crude, they have the desirable properties which oils made from these crudes possess:
   (a) Permitting easier starting and more rapid distribution of oil throughout the engine under cold starting conditions.
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These oils—available in S.A.E. 10, 20, 30, 40 and 50 grades—come at a crucial time. Their value in promoting engine efficiency, long life, and economical maintenance will be hailed by operators of heavy duty equipment. For never before have these men needed the Veedol 90 Series Oils so much as they do today.

Your inquiry is invited.

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MADE FROM 100% PENNSYLVANIA CRUDE

REFINING NEWS and TECHNOLOGY

Chemists' Chief Calls on Army To Defer Young Scientists

NPN News Bureau

NEW YORK — The U. S. will enter the postwar period hopelessly short of young chemists and chemical engineers if Selective Service drains the number now in training in American colleges and universities, Dr. Thomas Midgley, Jr., president of the American Chemical Society, said in a message in the society's 40,000 members.

Insisting that chemists, chemical engineers, bona fide undergraduate students, graduate students and chemical operators should be granted occupational deferments, Dr. Midgley said tragic results would inevitably follow if the postwar reconversion period were prolonged because of a dearth of chemists and chemical engineers.

Much Revised 88 to Be Replaced This Week By Streamlined OPA Price Schedules

NPN News Bureau

WASHINGTON—Revised Price Schedule 88, which has governed petroleum prices above the retail level since the beginning of 1942 and has accumulated 154 amendments in that time, is scheduled for retirement this week.

It will be replaced by two streamlined new price regulations. One, to be known as maximum price regulation 88, will cover prices of gasoline, kerosine, fuel oils and Diesel fuels, naphthas, solvents and liquefied petroleum gas. The other, as yet unnumbered, will include lubricating oils, greases and miscellaneous products.

Appearance of these two schedules completes the task of reorganization that was begun last August, when crude oil prices were removed from RPS 88 and embodied in a new MPR 436. Principal objective of that task, according to OPA, is to provide "regulations which are easy to handle and which express in clear language and simple sentences the intention of the Administrator."

As one step toward this end, the new regulations contain detailed instructions on the steps a person should take to ascertain his maximum price. The idea is to enable him to determine his ceiling quickly without reading the entire regulation.

Primarily, the new regulations merely rearrange and simplify the terms of the old Schedule 88. However, they contain some significant new material. This material has been discussed at length in informal industry meetings and in sessions of P.I.W.C. marketing committee.

Greatest volume of discussion was provoked by OPA's proposal to define the term "class of purchaser," as used in the "freeze" clauses of the regulation. These clauses have required sellers to take as their ceilings the price on "the last sale of a substantial quantity of the same product to a purchaser of the same general class" in the 60 days prior to Oct. 15, 1941.

Industry and OPA have disagreed on the meaning of that term, industry contending that it describes "functional" differences among customers (such as jobber; distributor; commercial, industrial, or private consumer; service station tank car dealer; divided or undivided tank wagon dealer etc.). OPA, on the other hand, has taken the position that the only valid distinctions among customers are those reflected in customary price treatment.

OPA's original draft of the definition, embodying this concept, provoked hot protest from industry. OPA then suggested that industry, through its P.I.W.C. district marketing committees, propose an alternative. The definition finally written into the new schedules is that alternative, plus some OPA modifications to which the marketing committee agreed.

The phrase, according to this definition, "refers to the practice adopted by the seller in setting different prices for a commodity for sales to purchasers performing different functions . . . . or for purchasers performing the same function but located in different areas or buying in different quantities or grades or under different conditions of sale.

Burden Put on Seller

"Price," the definition continues, "is prima facie evidence but not conclusive evidence to be considered in determining if a purchaser belongs to a particular class. However, a lower price to a particular purchaser which was to meet competition and otherwise was inconsistent with the seller's practice . . . . shall neither result in placing the particular purchaser in a lower price class nor be considered in determining a seller's maximum price."

This wording recognizes oil men's contention that some price distinctions existing during the base period were not truly reflective of classification of customers, but were forced by temporary conditions of competition. However, it is left to the seller to demonstrate that this was the case, if a purchaser complains that the price charged him is higher than that he enjoyed during the base period.

Another definition added to the new regulations is that of "sale." The meaning of this term has been broadened to include deliveries to tank wagon resellers during the base period under a contract made before the base period, if the contract provides for varying the price in accordance with a stipulated posted or mar-

Safety Reminder No. 5

Keep warning signs in good condition to avoid locomotive switching close to loading track

Planes, tanks and other motorized equipment are only as important as the destructive blows they can deliver the enemy —gasoline is the fuel that makes possible completion of their deadly missions . . . to help supply this vital fuel, Hanlon-Buchanan is supplying Butanes and Stabilized Natural Gasoline—STA-VOL-ENE the "Natural" known throughout the World.

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London, England

ket price at the point where the buyer resells.

A third addition to both regulations is a requirement that shifts from a delivered price basis to an f.o.b. shipping point price basis, when such a shift increases the laid-down cost to a purchaser, must be reported to the appropriate OPA regional office within 10 days after a sale is made.

This provision does not mean that OPA intends to sit in judgment on such switches; it has adopted the principle, on this matter, of relying on industry's self-restraint. But OPA wants to know about switches as possible indications that existing prices are out of line.

In addition to these three, the new MPR 88 (the gasoline and light fuels schedule) contains the following other new points:

1—Price control is removed from exchanges between refiners; sales between original suppliers pursuant to assignments or reassignments under Directive 59; sales between corporations when one is a wholly owned subsidiary of the other or when both are wholly owned subsidiaries of a third; and sales by Defense Supplies Corp. at pipeline termini.

2—A provision regarding passing on of future taxes has been added.

3—Customary records are required to be kept and made available for a period of two years.

4—Definitions and explanations have been added for such terms as "product of the same grade," "f.o.b. refinery price," "tank wagon price," "tank wagon area," "marketing" and "eligible marketer," "broker" and "eligible broker," "brokerage commission" and "original supplier."

5—All specific prices for fuel oil in the rationed area include the 0.3 cents per gal. increase allowed to cover extra expenses incident to rationing, and this 0.3 cents may not be added again by a seller.

6—Provisions have been added to allow certain marketers, on sales f.o.b. a refinery with a specific maximum price, to add a mark-up which will not increase the cost to a buyer to more than 0.125c over such specific ceiling. Certain brokers are authorized to charge a brokerage commission under same conditions.

Certain changes and additions have been made to specific maximum price clauses; methods of establishing ceilings by application, and determining ceilings on basis of another seller's maximum price, have been modified; and a surcharge of 1c per gal. on tank wagon deliveries of gasoline of less than 200 gal. are allowed.

NPN Prices Written In

The schedule for lubricating oils and greases will also contain the record-keeping requirement and the provisions exempting sales between refiners and affiliated companies from price control. In addition, it will include the following two alterations:

1—Prices for sales of stock oils in bulk lots appearing in the Oct. 8, 1941, issue of NPN are now written into the regulation as specific maximum prices with appropriate descriptive headings.

2—Price lists of refiners, blenders, and compounders as customarily published for use of their sales departments, customers or distributors are required to be filed with OPA within 30 days after effective date of the new regulation.

Wax Production Hits Record in 1943 To Meet War Need

NPN News Bureau

WASHINGTON—A record production of 380,000 tons of all petroleum waxes in 1943 by approximately 50 refineries in the U. S., and a forecast of a 1944 production of 60,000 tons of micro-crystalline wax alone, were reported by PAW in a review last week of the job petroleum waxes are doing in the war.

So critically scarce are micro-crystalline waxes that the 1944 production is being allocated in accordance with the relative importance of the end uses, PAW said. Refined and crude scale waxes are also short, PAW pointed out, but are not under allocation.

While paraffin waxes have been used in small quantities for packaging foods for 40 years, military demands today are focusing attention on the harder-to-get micro-crystalline waxes. Last year, 60% of the output of micro-crystalline wax was used to package field rations for overseas service men, to manufacture ordnance wrappings and to dip-coat Army ordnance and ordnance metal replacement parts.

Other military uses of micro-crystalline wax include bomb desensitizing and airplane de-icing compounds, proofing Army shoes against mustard gas, and 30 tons of micro-crystalline wax were allocated to the manufacture of one item alone—a special hair preparation sold only to service men.

"Without the American oil industry it would be difficult to preserve the Army and Navy rations and keep the armed forces' ammunition dry," PAW said, and the extent to which the industry has thrown itself into the production of wax to meet military needs is indicated by the fact that the wax content of wax bearing crudes is only about three-fourths of one percent.

PAW said wax, strangely enough, can be more moisture proof than tin. Experience of our armed forces reveals that water often penetrates the hermetically sealed metal-lined wooden ammunition boxes when they are hurled from a ship. Ordnance plants are now waterproofing aircraft ammunition packages by a new double-wax dip process.

Some of the new, war-born uses of waxes are here to stay, postwar, PAW said, particularly wax-laminated paper packaging for tobaccos and cheese instead of paper and foil, as well as chip board containers with wax-laminated glassine liners for foods and bakery goods.

Paraffin wax is refined from distillate or overhead stocks, while micro-crystalline waxes are separated from residual stocks. Micro-crystalline waxes have a higher molecular weight, higher melting point and greater flexibility.

PAW disclosed that improved methods of wax application have made possible the production of commercial wax papers with moisture transmission rates over a 24-hour period as low as two-tenths of a gram per 100 sq. in. at a temperature of 100 deg. F. To help conserve the supply of micro-crystalline wax, tests are being made of compounds requiring a greater proportion of paraffin wax, PAW said.

Latin America Ups Imports Of Crude Rubber To U. S.

NPN News Bureau

WASHINGTON — Imports of rubber from Latin America in 1943 accounted for nearly half of the U. S. crude rubber imports from all sources, Rubber Development Corp. has announced. For the first 10 months of the year Rubber Development disclosed, actual imports of rubber from Latin American sources totaled 22,380 long tons compared with 9548 tons during the same period in 1942. Total crude rubber imports from all sources totaled 51,008 tons.

RDC estimates that total imports of crude rubber from Latin America for the whole of 1943 will amount to 26,400 long tons against 14,486 tons in 1942. In addition to these crude rubber imports, approximately 3300 tons rubber content of tires and tubes will have been made available to the American republics and the U. S. by Brazil during the year.

200 Shell Heroes Back at Work

NPN News Bureau

CLEVELAND—More than 200 Shell Oil Co. employes have been released from military service and are now back on their jobs, *Shell News*, company publication reports.

'Gas' Gloom for Whole U. S.

NPN News Bureau

CHICAGO—Possibilities of "A" coupon holders all over the country being reduced in their gasoline allotment or losing it entirely, were mentioned to reporters by Col. Bryan Houston, deputy administrator of OPA, when he passed through Chicago Jan. 17.

He asserted that refinery output of motor fuel had reached its capacity and war needs were increasing daily. Should the war in Europe last beyond next fall, he added, "A" coupon holders in all areas will find their gasoline rations reduced and might even find them completely cut off in favor of war demands.

Statement credited to Houston by some publications was that only midwestern motorists would be cut OPA, here, however, said that Col Houston's statement referred to the whole country.

NEW CITATION FOR BROWNIES!

ARMY E ★ NAVY

...war production record creates optimism for Brownies postwar plans.

BROWN STEEL TANK COMPANY
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To Our Fellow Workers:

We wouldn't be human if we didn't feel like bragging about the records all of us made in 1943...but we're doing our bragging in a spirit of humble gratitude.

It wasn't an easy year, because nobody can make a record like ours just by coasting. But it was a year filled with triumphs and promise.

For 1943 was more than just the biggest year in our history. It was the year that showed how much and how well Brown workers can produce when pressure is on.

And it was the year we stopped worrying about what's going to happen after the war. With men and women like you on our side, there's nothing to worry about.

Is it any wonder we are proud...and very grateful?

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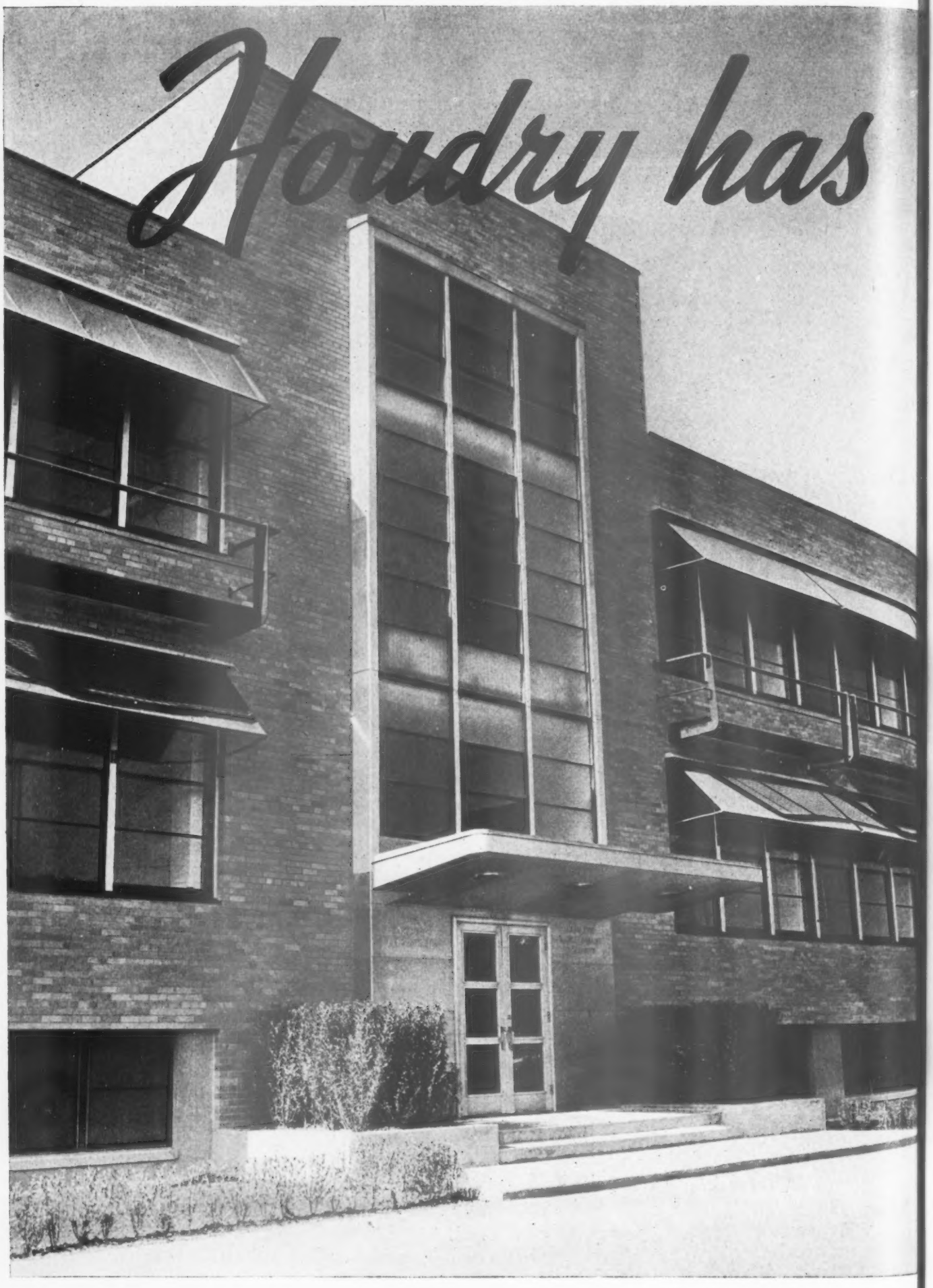
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A Houdry licensee gets more than the mere right to build and operate catalytic units. Even more important, perhaps, is the continuing availability to Houdry licensees of the scientific research data developed at the Houdry Laboratories.

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The Houdry Catalytic Processes are available to any and all American refiners, under license arrangements, subject to approval by the United States Government.

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HOUDRY CATALYTIC PROCESSES ... FOR VICTORY IN WAR FOR PROGRESS IN PEACE

Briefs from Week's News

Priority Control Considered To Aid Shipments East

NPN News Bureau

WASHINGTON — Oil transportation officials are discussing some method of priority control on rail shipments to the East Coast because of growing shortage of tank cars caused by withdrawal for imperative military requirements, general slowing down of movements and an insufficiency of tank trucks due to increased demands for service and a shortage of new units, parts, and manpower.

Because of obvious difficulties, officials are reluctant to impose priority control to speed up tank car shipments, especially to the Atlantic Seaboard, but admit it may be necessary if the situation becomes more critical.

Briefly, some such priority system as follows might be imposed: if in the Chicago switching district there were five trainloads, four of them petroleum, awaiting locomotives and train crews for transshipment eastward, and there were only four train crews available, all of the crews would be assigned to the petroleum trainloads and the fifth, whatever it might be, would be delayed until crews and locomotives were available.

ODT reported, meantime, that it was taking "immediate steps" to speed up petroleum product movements to the East.

Rail Hauls East Up 11,467 B/D

NPN News Bureau

WASHINGTON—Tank car shipments of crude and products to Dist. 1 averaged 683,204 b/d during the week ended Jan. 22, up 11,467 b/d over the preceding week. An actual count showed 64,100 cars in service to Dist. 1 as of Jan. 1.

WPB Releases 2044 Vehicles

NPN News Bureau

WASHINGTON—A total of 2044 vehicles was released under operation of truck rationing Jan. 16 to 22 inclusive, WPB announced Jan. 27. Total included 351 light, 825 medium, 518 heavy trucks, 319 trailers, and 31 third-axle attachments.

Dakota Transporters Battling Double Handicap Of Heavy Draft Calls and Parts Shortage

NPN Staff Writer

SIOUX FALLS, S. D.—Army draft of pre-Pearl Harbor fathers is being felt among the petroleum transporters operating out of this hub city, and there is a possibility that some of the transport equipment will be grounded if it continues and unless there is an easing up on repair parts for the trucks.

Heavy tires of AA grade are fairly easy right now in this area, but operators are expecting difficulty soon in getting them.

However, in the relatively short time authorized common carriers have been operating in South Dakota, some unique achievements have been marked up in local transport service, and the operators can have confidence that whatever blow may fall next, it will be successfully met.

Dan Dugan Transportation Co. reports losing two drivers to the draft during the past two weeks, two more are about ready to go and a fifth man will follow shortly, "and the draft boards are breathing hard on the back of the necks of others." Dugan operates 45 trucks with varying capacity from 3500 gal. to 4250 gal.

Dan Dugan, head of the company, is also president of South Dakota Petroleum Transport Assn. J. W. McKeever, Rapid City, is vice president, and Lowell Crabb, of Petroleum Carriers, Inc., is secretary-treasurer.

Petroleum Carriers, Inc., say they operate 15 transports and that two of their drivers have just been moved over into the A-1 draft classification. One of these men has three children and the other, one child. The company also reports a big turnover in drivers due to hectic war-time conditions with apparently plenty of other jobs available. The men stay awhile and like to move on, running the total men employed up to 25 or 30 drivers during the past three months.

Bakertrux for the present are not worried about the draft of drivers, except for Mr. Baker's own sons. He has one son in the Army now and a second, who also drives a transport, is expecting to leave at any time.

Couch Motor Co., which operates both out of here and Yankton, lost two drivers to the Army last fall, but none recently, Mr. Couch said. He needs two drivers at the present time, however.

Ignore Essential Status

Opinion of most of these transport companies is that draft boards are ignoring the "essential" status of drivers and that they are being drafted as their numbers come up. However, one mechanic working for the Dugan company has been deferred, and Joe Adrian, executive secretary of South Dakota Petroleum Transport Assn., said he had just received notice of deferment of a transport driver working out of Aberdeen.

As for tires and repair parts, the transporters say they are finding both tough, but the Dugan company said that so far they have been getting AA, or best grade war tires where they formerly were able to obtain only AB and AC grade, which were not so good in the bigger sizes. Reports from elsewhere mention the difficulty of obtaining truck tires and the local operators are wondering how long their success in getting them will continue.

Replacement parts are the worst trouble, with inserts and mains leading the list of items. These bearings, the transporters say, give no warning before they go out and when they go, out goes the crank shaft too.

"Only way we can keep our trucks going at all," representative of one company said, "is to scour the land for parts. Our men comb the garages and supply houses from Chicago to the Twin Cities and west to Aberdeen."

History Brief But Lively

The history of petroleum transporters as public haulers in South Dakota is not very long. Joe Adrian, who lives at Yankton but is a frequent visitor here in his state-wide work, is not only executive secretary of the transport association, but holds a similar position with the South Dakota Independent Oil Men's Assn., the jobber organization of which 85% of the independent jobbers in the state are members. He is also chairman of the state ODT committee on local delivery and secretary to the ODT advisory committee, member the petroleum industry general salvage committee collecting scrap iron, rubber and paper in the state, member A. P. I. C. committee and of South Dakota gasoline tax evasion committee, along with some others.

"Until about three years ago," he said

Cites Low Cost to Public For Crude Price Boost

Now we come to the effect upon the population of the price raise. The armed forces use 32 per cent of the oil. The drivers of passenger cars use only 15 per cent. It gets down into fractions, do you not see—eighty-five one-hundredths of 1 cent per gallon on gasoline at 35 cents per barrel increase on crude. The drivers of passenger cars get only 15 per cent. Industries, 12 per cent; public utilities, 2 per cent; operators of trucks, busses, and taxicabs, 12 per cent. They may complain of the price being raised a little bit, for they get all the gas they need anyway. Railroads and transportation, 8 per cent; householders heating with oil, 5 per cent; farmers, 5 per cent; all others, 9 per cent.

—Rep. Disney in Speech on floor of House

Where Performance Really Counts

DEPENDABLE

Champion Spark Plugs

ARE ON ACTIVE DUTY!

Better performance and greater dependability are the two qualities that can create a preferential demand for a particular make of spark plug.

Champion Spark Plugs are being used by our armed forces wherever the war is being waged on land, water, and in the air. The traditional dependability of Champions under the most adverse operating conditions is thus being emphasized as never before. Thus, too, Champions are adding daily to their reputation as the first line spark plug,—a guarantee that the Champion franchise will lead in volume, turnover and profits, now, and in the post war market.

LET'S ALL BACK THE ATTACK — BUY WAR BONDS

Don't storm at your Secretary!

Sure, it's taking a long time to get your man—the one you met in Washington—but that's not her fault! . . . Remember, when she asked you with what war agency he was connected in Washington, you said it was either PAW or PIWC, or possibly WPB, still it might be OPA? . . . So she began the "hunt" via costly and extremely busy long distance telephone service!

Using the long distance lines to "hunt" your man in government war-oil service is not necessary if you have a copy of the THIRD EDITION of Platt's War-Oil Directory at your elbow . . . For this Directory contains the telephone numbers of all persons connected with the government-industry war-oil program and, in addition, it gives their names, titles, company affiliations and addresses—with the new postal zone numbers!

Refer to Platt's War-Oil Directory before you place a phone call . . . It will not only save your own time and money on long distance calls, but it will also keep the lines open for the nation's important business.

Clip the coupon below and send for YOUR Directory today!

SPECIAL NOTE!—Save yourself money on this Combination Offer—Send in your subscription to NATIONAL PETROLEUM NEWS now—regardless of when it expires—and we'll send you the Third Edition of Platt's War-Oil Directory for only $1.50 extra!—In other words, you get BOTH for only $6.50!

BELOW is a partial list of the contents of Platt's War-Oil Directory. There are over 2,100 names, addresses and telephone numbers of government-industry personnel in this Third Edition.

CONTENTS

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Office of Price Administration
Petroleum Industry War Council
Office of Rubber Director
Rubber Reserve Company
War Production Board

Other Government War Agencies

Army and Navy Petroleum Board
Defense Plant Corporation
Defense Supplies Corporation
Foreign Economic Administration
National War Labor Board
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WAR-OIL COMMUNICATION SERVICES

in citing transportation developments, "South Dakota had no ICC carriers, or interstate haulers, so we got busy and organized three co-operatives, following up the ODT idea of pooling equipment. Petroleum Carriers, Inc., the largest one, was set up to handle all petroleum transporting in the eastern half of the state, east of the Missouri river, with headquarters in Sioux Falls. Rose Bud Oil Transport Co., Inc., took care of what we call the Indian reservation district, consisting of seven counties in the south central portion of the state, just west of the Missouri river. Oil Transporters, Inc., Rapid City, was the third pool, designed to serve all the rest of the state west of the Missouri river," he said.

Got Idea from NPN Story

The idea, or co-operative plan for meeting the war transportation emergency came from an NPN story about a similar proposed organization on the Atlantic coast, according to Mr. Adrian.

"Walter Dumont, then trapsportation director of PAW Dist. 2 at Chicago," he said, "came out and told us it was tough, but we are going to have to give up our tank cars for eastern service. We explained to him that all transports in the state were operating as private carriers and that we had no common carriers."

Incorporating the three truck pools within the state, Mr. Adrian said, was an effort to obtain the best of service for all oil companies in South Dakota suddenly needing it in the emergency, and definitely fixed the responsibility of the operators, and enabled the securing of insurance. Regular truck lease forms were prepared and signed by the co-operative transport company and the transport owners in each case. They were to be non-profit organizations and only 5% was deducted from the total income to be used in defraying expenses. Even this amount was subject to adjustment either way, and the profit left over was passed on pro-rata to the membership.

Cool Reception from ODT

While ODT wanted co-operation and pooling of equipment to insure sufficient transport transportation to keep products moving, for some reason, ODT was never very eager about the setup in South Dakota, although Mr. Adrian said he made a trip to Washington and went into detail regarding the methods and purpose.

But by that time other private transport truck owners began to move into the state. They soon obtained ICC interstate authority as common carriers, and various of the co-op transport owners began to follow, and as the co-ops themselves had served their purpose, they too passed on into private hands and the largest of them—Petroleum Carriers, Inc.—we have already mentioned in the opening paragraphs of this article. But many of the pooling practices originating in the co-operative movement, such as the leasing to each other of complete equipment, are still being followed.

(*Continued from p. 20*)

dependents in District 2 to a mere handful of large corporate units.

In spite of the repeated assurances of Petroleum Administrator Ickes that PAW and its committees of governmental supervision are self-liquidating agencies and that their existence will come to an end as soon as the present emergency is over, the independent should view with alarm the destructive inroads made upon private enterprise by Government control agencies, and through his associations make immediate plans to bring about their dissolution with the declaration of Peace.

In looking ahead and planning for the postwar period, it is necessary to start with some reasonable premise on the length of the duration. The composite thought of military leaders as reflected through the press allows us to hope for a cessation of hostilities in Europe during the summer of 1944, with final peace in the Pacific not later than September, 1945.

With the declaration of peace, the independent will immediately be faced with the problems of readjustment, but as some benefits are derived from all emergencies, the independent can attack this problem with a new deck of cards.

Good Management Is Key

The waste and inefficiencies of past operations have been eliminated by the war, and independent management has been converted into an operating efficiency greater than has ever been experienced before. This rejuvenated management, which is the key to all our postwar problems and the profits we hope to accrue, is ready and impatient to function, but is restrained from realizing its ambitions until the return of our men from the fronts.

These men, of whom there will be 11,000,000, will return after a training with the Army or Navy along specific lines. These men will know the value of carrying through the plans of management—they will know the value of responsibility to management—and they will provide a technical and mechanical training, the excellence of which management has never before been able to employ.

Speaking particularly to independent bulk and retail distributors, I urge you forever to lay aside the "hit and miss" management system which has played an important part in independent distribution in the past. Keep management functioning as such, and make this possible through the development of a real hand-picked sales organization.

Co-Operative Buying?

If this plan is followed, management can confine its efforts to promotion of new merchandising plans and concentration on buying, which is its next most important function after selling.

Postwar buying for bulk and retail distributors will include petroleum products, allied lines such as tires, batteries,

Serving the PETROLEUM INDUSTRY for 40 years

BLACKMER · ROTARY · PUMPS

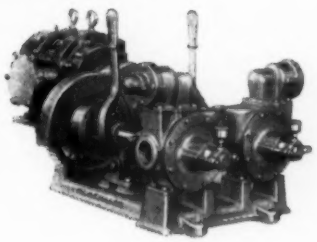
they are Self-Adjusting for Internal Wear!

due to "Bucket Design" (swinging vane principle)

That means normal capacity throughout the life of the buckets - no loss due to wear. 20 years of service is not unusual for a Blackmer pump.

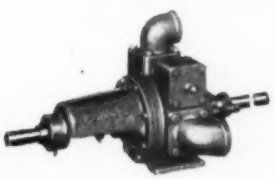
BULK PLANT PUMPS

Capacities 50 to 750 GPM (single pump) Pressures to 300 psi. Single or multiple units. All standard drives. Direct-connected units 5-10-20 GPM. 100 psi.



TRUCK PUMPS

Capacities 20 to 200 GPM. Power take-off or Gasoline Engine drive. Quiet, efficient units that speed up deliveries — increase truck road time.



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Capacities 7 to 25 GPM. Made in 54 different models. Standard and heavy duty barrel pumps and complete refueling units.

Ask any pump man about Blackmer Rotaries.

Write for Bulletin No. 304: FACTS ABOUT ROTARY PUMPS, and Bulletins on Truck Pumps and Hand Pumps.

Blackmer Pump Company, 1882 Century Ave., Grand Rapids 9, Mich.

BLACKMER Rotary PUMPS
"BUCKET DESIGN"—SELF-ADJUSTING FOR WEAR

Officers of the Kansas Oil Men's Assn. are shown here with the principal speakers for the annual convention in Wichita Jan. 24-25. Front row, left to right, are: Jack Jacquiss, Coldwater, retiring president; Paul R. Kempf, Ann Arbor, Michigan, executive secretary of the National Dixie Distributors; Governor Andrew F. Schoeppel of Kansas, toastmaster; Alex Dreier, NBC war commentator and guest speaker and Lane Dunagin, Topeka, newly elected president. Rear row, left to right: E. F. Underwood, Kansas City, Mo.; Warren C. Platt, editor of the National Petroleum News; A. C. Carpenter, Ottawa, a former association president; C. L. Henderson, Wichita and C. R. Sullivan, Wichita

filters, spark plugs and other accessories, and new items developed as a result of the war.

Few independent distributors as single units are able to purchase on a volume basis. This is true because the 7200 independents in this area are "small business"; however, they will be forced to compete in both price and quality with the major companies and with Sears & Roebuck, Montgomery Ward and other chain distributors.

We in Dixie Distributors have long known of the value of co-operative buying, and within our national organization have developed a volume that permits us to compete on any product with all types of distributors.

Through a tremendous reduction in our costs, our savings to Dixie franchise holders has amounted to hundreds of thousands of dollars.

You, too, can effect this saving but only through co-operative buying groups, and your immediate postwar plans should include the organization of such groups.

The merchandising plans of Dixie are not selfish—and, in fact, our only reason for existence is to further the interests and profits of the independent. Our plan of operation is open to all and if, for any reason, your policies will not permit your affiliation with the Dixie group, we urge you to originate groups of your own or join other established groups in order that these savings in cost can contribute to your postwar profits.

Co-operative buying involves many difficulties, but none that a determined group of independents cannot overcome; and to assist in hurdling these obstacles sometimes injected into buying plans by coercive interests, Dixie will be glad to give you the history of its experience and do everything possible to assist in the organization of new and other independent buying organizations.

Postwar plans for independent distributors throughout the country must evolve around the basic functions of buying and selling, and keen management will see the necessity of independents banding themselves together to meet the competition of interests that are constantly trying to freeze them out, even as nations have had to do to protect themselves from the invaders who would destroy that for which they have worked and fought and struggled. In closing, if I could leave only one thought with you it would be this: In union there is strength; in isolation there is only annihilation.

This group was snapped during a lull in proceedings at the annual convention of the Kansas Oil Men's Assn. in Wichita. Front row, left to right: C. S. Bishop, Bishop Oil Co., Dodge City; C. E. Holmes, Wichita, association secretary; A. F. Geyer, Dixie Oil Co., Waterville and Jack Jacquiss, retiring president. Standing, left to right, are Denny Klepper, Denny Klepper Oil Co., Wichita; R. O. Brown, Brown Oil Co., Admire, Kans., and Dean Kurmiel, Kurmiel Oil Co., Hiawatha, Kans.

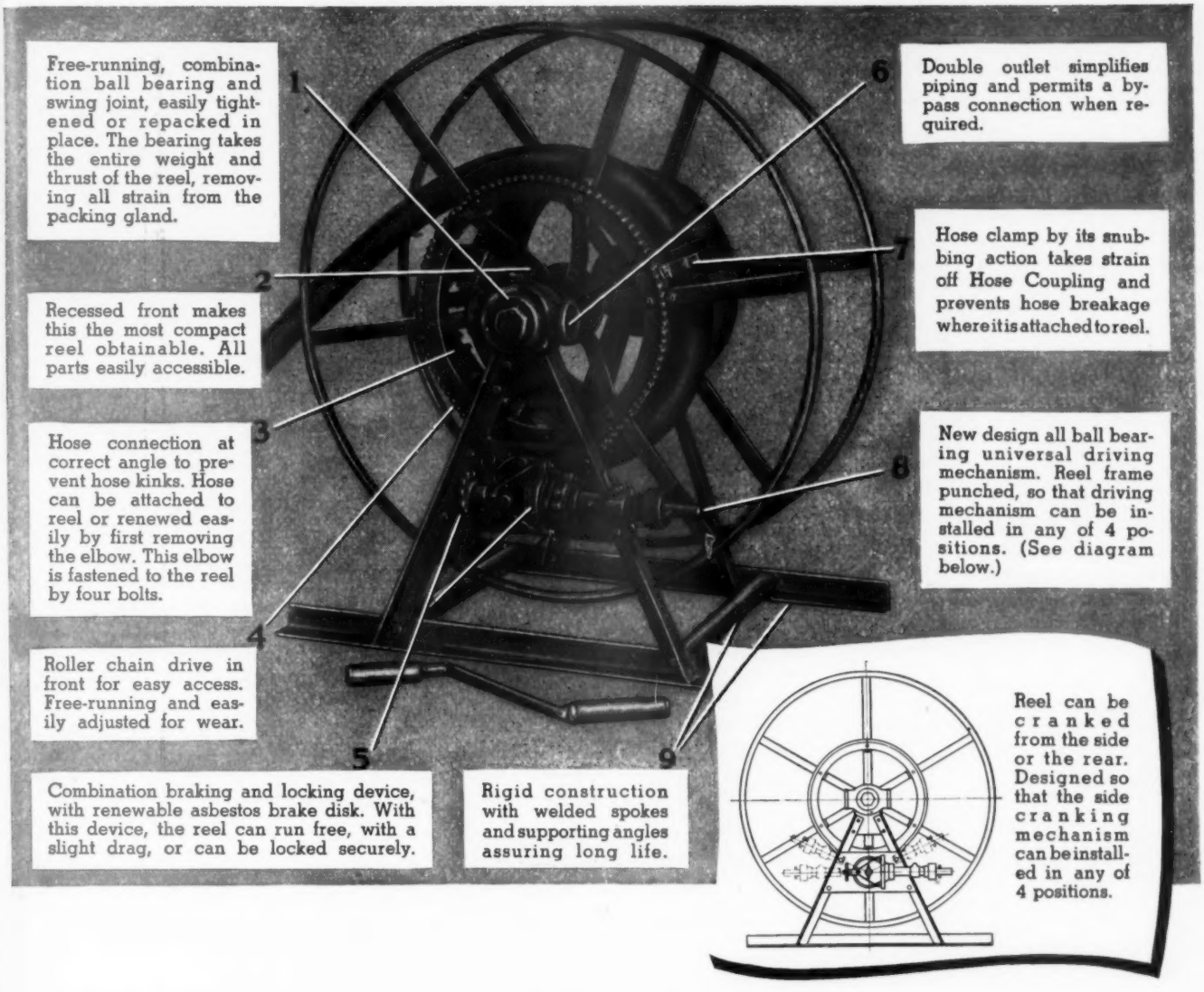
Pure Oil Expands Production And Research Facilities

NPN News Bureau

CHICAGO—Pure Oil Co.'s own known oil reserves are greater now than they were a year ago, and further search for new reserves has been greatly stepped up, according to "Pure Oil War Book," a 16-page illustrated booklet being sent to all employes and 42,000 company stockholders.

The company's technical research payroll for present and future development of products is double what it was a year ago, the announcement said, and the company's pipeline and marine transport facilities are carrying a tremendous load of vital war supplies—aviation gasoline, lubricating oils, special Navy fuel oil, military all-purpose gasoline and other products.

In a letter accompanying the booklet, President Henry M. Dawes said that all the company's plants have been paid for out of current resources and funds of the company and without contribution by the government. Due to the flexibility obtainable in the most modern refinery practice, he said, all will be fully available after the war emergency to produce new and improved products.


1
Free-running, combination ball bearing and swing joint, easily tightened or repacked in place. The bearing takes the entire weight and thrust of the reel, removing all strain from the packing gland.
2
Recessed front makes this the most compact reel obtainable. All parts easily accessible.
3
Hose connection at correct angle to prevent hose kinks. Hose can be attached to reel or renewed easily by first removing the elbow. This elbow is fastened to the reel by four bolts.
4
Roller chain drive in front for easy access. Free-running and easily adjusted for wear.
5
Combination braking and locking device, with renewable asbestos brake disk. With this device, the reel can run free, with a slight drag, or can be locked securely.
Rigid construction with welded spokes and supporting angles assuring long life.
6
Double outlet simplifies piping and permits a by-pass connection when required.
7
Hose clamp by its snubbing action takes strain off Hose Coupling and prevents hose breakage where it is attached to reel.
8
New design all ball bearing universal driving mechanism. Reel frame punched, so that driving mechanism can be installed in any of 4 positions. (See diagram below.)
9
Reel can be cranked from the side or the rear. Designed so that the side cranking mechanism can be installed in any of 4 positions.

The New Hose Reel You Have Been Looking For

COMPACT, RUGGED, LIGHT IN WEIGHT, BALL BEARING CONSTRUCTION THROUGHOUT

The new Philadelphia Valve Co. reel is the finest reel built. It is compact, rugged, and light in weight. All parts are of steel, malleable iron, or bronze; no cast iron is used. It is ball bearing throughout with hardened and ground races. (6 ball bearings are used.) It will never wear out.

The reel can be changed from top winding to bottom winding by reversing the hose connection and rotating the drum. All working parts and hose connections are in front and easily accessible. It is light in weight, a reel that holds 100 feet of 1½" hose, only weighs 93 pounds.

We can furnish hose reels in any size or shape. They can be furnished for installation either in bucket box at rear of truck or in underslung box on side of truck. Give inside dimensions of box when writing for information. Special reels can also be furnished for Airfield Refueling Pits and Ship Docks.

Delivery can generally be made in a few days after receipt of order. For sizes, prices, and dimensions, write for Catalogue No. 165.

PHILADELPHIA VALVE COMPANY

ARAMINGO AVENUE AND ONTARIO STREET, PHILADELPHIA 34, PA.

Pacific Coast Distributor: Hercules Equipment & Rubber Co., 550 Third St., San Francisco, Cal.

Forecast Drilling Spurt In Midwest Area From Revised PAO 11

NPN News Bureau

WASHINGTON — PAW Jan. 20 relaxed drilling restrictions in so-called "Cincinnati Arch-Nashville Dome" area, comprising a number of counties in Indiana, Ohio, Kentucky and Tennessee, with issuance of Supplementary Order No. 10 to PAO 11.

The order permits operators to drill or deepen wells on five-acre spacing to a depth not greater than 1200 feet, and on 10-acre spacing to depths not exceeding 1800 feet.

In announcing the order, Deputy PAW Davies said he anticipated "that the total amount of additional material which will be expended in new drilling under the order will not be large because of the shallow depth of the wells, and because a large percentage of the material to be used probably will be second-hand".

Mr. Davies said not much additional productive capacity was expected by relaxation but that any that is obtained will help fill the pressing need for oil that we wish to facilitate drilling in the area."

Counties in which the order is effective in four states follow:

INDIANA

Adams, Allen, Bartholomew, Benton, Blackford, Boone, Brown, Carroll, Case, Clark, Clinton, Crawford, Dearborn, Decatur, De Kalb, Delaware, Elkhart, Fayette, Floyd, Fountain, Franklin, Fulton, Grant, Hamilton, Hancock, Harrison, Hendricks, Henry, Howard, Huntington, Jackson, Jasper, Jay, Jefferson, Jennings, Johnson, Kosciusko, LaGrange, Lake, La Porte, Lawrence, Madison, Marion, Marshall, Miami, Monroe, Montgomery, Morgan, Newton, Noble, Ohio, Orange, Oren, Parke, Porter, Pulaski, Putnam, Randolph, Ripley, Rush, St. Joseph, Scott, Shelby, Starke, Steuben, Switzerland, Tippecanoe, Tipton, Union, Vermillion, Wabash, Warren, Washington, Wayne, Wells, White, Whitley.

OHIO

Adams, Allen, Auglaize, Brown, Butler, Champaign, Clark, Clermont, Clinton, Crawford, Drake, Defiance, Delaware, Erie, Fayette, Franklin, Fulton, Greene, Hamilton, Hancock, Hardin, Henry, Highland, Huron, Logan, Lucas, Madison, Marion, Mercer, Miami, Montgomery, Morrow, Ottawa, Paulding, Pickaway, Pike, Preble, Putnam, Ross, Sandusky, Scioto, Seneca, Shelby, Union, Van Wert, Warren, Williams, Wood, Wyandot.

KENTUCKY

Adair, Allen, Anderson, Barren, Boone, Bourbon, Boyle, Bracken, Bullitt, Campbell, Carroll, Casey, Clark, Clinton, Cumberland, Edmonson, Fayette, Franklin, Gallatin, Garrard, Grant, Green, Hardin, Harrison, Hart, Henry, Jessamine, Jefferson, Kenton, Larue, Lincoln, Madison, Marion, Mason, McCreary, Meade, Mercer, Metcalfe, Monroe, Montgomery, Nelson, Nicholas, Oldham, Owen, Pendleton, Pulaski, Robertson, Rockcastle, Russell, Scott, Shelby, Simpson, Spencer, Taylor, Trimble, Warren, Washington, Wayne, Woodford.

TENNESSEE

Bradford, Cannon, Cheatham, Clay, Coffee, Cumberland, Davidson, DeKalb, Fentress, Franklin, Giles, Grundy, Hickman, Jackson, Lawrence, Lewis, Lincoln, Macon, Marshall, Maury, Moore, Morgan, Overton, Pickett, Putnam, Robertson, Rutherford, Scott, Smith, Sumner, Trousdale, Van Buren, Warren, White, Williamson, Wilson.

South Arkansas Production Increases 1,000,000 Bbls.

Special to NPN

EL DORADO, Ark.—Oil production from the 45 oil and gas fields of Southern Arkansas during 1943 increased in excess of one million barrels over 1942. Oil production has increased steadily in Southern Arkansas for the past 7 years, or since enactment of its model conservation law, which has stabilized the oil industry of the state, according to Arkansas Oil and Gas Commission.

Four new pools were discovered during 1943, together with some extension of older pools. These new pools and extensions account for increase in reserves of 56 million barrels. Since 27½ million barrels of oil were produced during the year, the added reserves represent a balance of 28½ million barrels in excess of production for the year.

Final calculations on total reserve for the state have not been completed but present estimate is 475 million barrels, the report said.

Naturals Production Trend Up

NPN News Bureau

WASHINGTON—Daily average production of natural gasoline and allied products continuel to rise during November, 1943, totaling 10,762,000 gal., compared with 10,614,000 gal. for October and 9,960,000 gal. for November, 1942, the Bureau of Mines reported.

Total stocks at plants, terminals and refineries likewise increased, totaling 195,090,000 gal.

PAW Certifications Call for 5570 b/d Cut During February

NPN News Bureau

WASHINGTON—U. S. crude certification for the month of February has been set at 4,701,400 b/d by PAW. The figure represents a net decrease of 5570 b/d below the January production rate. Production rates certified for February for the five PAW districts, compared with production rates for February, 1943, follow:

Production Rates in Bbls. Per Calendar Day	February, 1944		Feb., '43
Dist. 1	(°)	(†)	(‡)
New York	13,400	..	13,900
Penna.	42,800	1,800	45,200
W. Va.	16,600	7,800	17,500
Total	72,800	9,600	76,600
Dist. 2			
Illinois	227,600	12,600	250,800
Indiana	14,000	..	15,700
Kansas	291,100	6,100	316,700
Kentucky	28,100	2,900	23,500
Michigan	50,200	200	58,100
Nebraska	1,200	..	2,200
Ohio	9,400	400	9,200
Oklahoma	356,000	28,000	379,700
Total	977,600	50,200	1,055,900
Dist. 3			
Arkansas	81,700	5,100	78,300
Louisiana	375,700	27,000	347,200
Mississippi	46,000	..	56,700
N. Mexico	116,600	5,900	104,900
Texas	2,018,000	132,000	1,460,900
Total	2,638,000	170,000	2,048,000
Dist. 4			
Colorado	7,000	..	5,600
Montana	24,000	300	20,700
Wyoming	98,800	5,800	86,600
Total	129,800	6,100	112,900
Dist. 5			
California	883,200	46,700	814,900
Other	.....	.....	100
Total U. S.	4,701,400	282,600	4,108,400

°Certified total petroleum liquids.
†Estimated natural gasoline and condensate.
‡Actual production, total petroleum liquids.

OPA to Base Crude Ceilings on Actual Deliveries In 1941

NPN News Bureau

WASHINGTON—Only contracts under which deliveries were actually made prior to or within 60 days after Oct. 1, 1941, may be considered in setting producers' crude oil ceilings, OPA provided Jan. 24 in Amendment 7 to MPR 436.

Previously, the regulation merely provided that when contracts in effect Oct. 1, 1941, contained prices higher than posted prices at the same field, the contract prices might be taken as the producers' maximum prices. It was assumed that deliveries were currently being made under such contracts and that their prices were already reflected in refined products prices.

However, OPA said, it has developed that certain long term contracts were negotiated prior to Oct. 1, 1941, providing that deliveries under these contracts would begin in 1944. The present amendment rules such contracts out of consideration.

At Makin—
drums
were "amphibious" too!

THE photograph at the right shows drums of gasoline and oil being floated ashore to supply American troops at Makin. The fuel in these drums is as precious as ammunition. *Seepage* would be disastrous. Yet the men roll the drums through the water with confidence—because they know that those drums have *hermetic seals* which are absolutely *watertight* and which keep every drop of the contents *safe*.

Throughout the Southwest Pacific, men are rolling drums of vital liquid supplies through the surf, and exposing them to torrential tropic storms — with complete confidence in the protection of water-tight, seepage-proof Tri-Sure Closures. This confidence is shared by every industry where drums are used. And the confidence is inspired by a record of performance which says, "*If it's in a Tri-Sure-equipped drum it's safe.*"

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TRI-SURE PRODUCTS LIMITED, ST. CATHARINES, ONTARIO, CANADA

Army Preparing to Ask Bids on 11,000 Used Trucks; Some Suitable for Oil Field Work

NPN News Bureau

CHICAGO—The Army is still trying to work out a means of disposing of 11,000 used trucks at public auction, according to R. F. Going, regional director, Office of Procurement Division, Treasury Department, who said on Jan. 24 that he had just returned from Washington where the matter was being discussed. As procedure has not definitely been set up, no trucks have as yet been turned over to him, Mr. Going said, but added that work might be received any time.

Information previously received here from F. A. Watts, PAW director of materials, and passed on to oil field operators by Dist. 2 PAW office, was to the effect that the Army was making the 11,000 trucks available for purchase by civilians through the procurement division of the Treasury. The PAW office here said it was understood that none of the trucks was of the tank wagon or transport type, but that all were suitable for general oil field work.

"These trucks are in Army camps all over the United States," according to the information from Mr. Watts. "They are of all sizes and vary in condition from very good to very poor. It is our belief that there will be many of these trucks in a state of condition far better than many of the trucks now used by petroleum operators and oil field trucking companies."

The trucks will be sold individually, Mr. Watts said in his letter, but apparently some delay has since developed as indicated by Mr. Going. Mr. Watts stated he had furnished the procurement division of the Treasury Dept. with a list of 3000 names of petroleum operators; but as the names of oil field trucking companies were not available, they were not included. Invitations for bids will be sent out within the next few days, he continued, and operators wishing to bid should contact the nearest regional office of the procurement division, Treasury Dept. Procurement division offices and personnel in PAW Dist. 2 were listed as:

Headquarters	States covered
J. H. Little, Regional Director, Edwin Dowd, Chief Utilization Div., 8th and Walnut Sts., Cincinnati 14, Ohio.	Indiana, Kentucky, Ohio and West Virginia.
R. F. Going, Regional Director, Burton C. Graham, Chief Utilization Div., 222 West North Bank Drive, Chicago 54.	Illinois, Michigan, Minnesota, North and South Dakota and Wisconsin.
John D. Tompkins, Regional Director, Burton C. Graham, Chief Utilization Div., 10 Forsyth Street Bldg., Atlanta 3.	Alabama, Florida, Mississippi, South Carolina, Tennessee and Georgia.
Hamilton Morton, Regional Director, R. N. Hansen, Chief Utilization Div., 609 Neil P. Anderson Bldg., Ft. Worth 2, Texas.	Arkansas, Louisiana, Oklahoma and Texas.
W. B. Edgar, Regional Director, John C. Crothers, Chief Utilization Div., 6th Floor, Porter Bldg., Kansas City 2, Mo.	Iowa, Kansas, Missouri and Nebraska.

Socony Files 'Experimental' New York Report

NPN News Bureau

NEW YORK—John A. Brown, president of Socony-Vacuum Oil Co., in a novel procedure in corporate reporting, advised the state of New York last month that his company had sold 800,000,000 gal. of oil products in the state last year, exclusive of sales to the government for war purposes. The report is termed by Mr. Brown "frankly an experiment." "While we make the usual annual reports on our total business," he explained, "we have not before attempted to analyze operations within any one state. We do so now for this reason: Socony-Vacuum is a large corporation, doing business both here and abroad, and presumably, therefore, it comes under the heading of 'big business'. Some people have been suspicious of 'big business' in recent years because they do not understand it. But there is clearly no reason for attacking a business because of its size. What matters is the way it operates.

" 'Big Business' is just small business grown larger. When it is properly conducted it means useful products for the people, jobs for wage-earners, investment for those who have saved some money, and taxes for the government."

In his "Report to the State of New York", submitted to Gov. Dewey Mr. Brown pointed out that Socony-Vacuum directly employed 6728 people in 1943 and paid them $21,300,000. It rented 1216 company stations to independent operators, while 5000 other dealers sold its products at their own stations. The company paid $3,600,000 for repairs to its own barges and tankers and $1,800,000 for new capital investment in marketing and manufacturing in New York State. It paid the state $2,900,000 in taxes and paid or made provision for paying $9,500,000 in gasoline taxes collected in New York state.

The company disbursed $8,000,000 in dividends during the year to stockholders. Its profits are put at about 5 per cent on net capital investment, or 6/10c per gal. on its own products. Socony puts its present net depreciated investments in New York State at $96,000,000, including three refineries, more than 1200 company-owned stations, 78 bulk plants, each representing a substantial investment in property and equipment, tank trucks and barges.

"If we consider all of these figures," said Mr. Brown, "we estimate Socony-Vacuum paid to the people of the state of New York around $50,000,000 in 1943."

Navy Has 'Invasion Preview' Films for War Plants

NPN News Bureau

WASHINGTON — A swift-moving film preview of the all-out invasions which are paving the way to Berlin and Tokyo has been prepared by the industrial incentive division of the Navy. By writing to the division at 2118 Massachusetts Ave., N.W., Washington, war plants may obtain prints for mid-February showing to workers.

A picture entitled "Battle for the Beaches" is based on actual combat scenes, many of them hitherto unrevealed. Its heroes are the fighting men of the U.S. Army, Navy and Marine Corps and those manning the thousands of landing craft which make landings possible. The picture traces the amphibious operations to date—Bougainville, Lae, Guadalcanal, Salerno and bloody Tarawa. Also shown are captured German films presenting the Nazi version of the Dieppe raid.

The film, which is available in both 16 and 35 mm sizes, runs approximately 25 minutes and has War Correspondent Quentin Reynolds as narrator. A nominal rental charge is made.

Second Big Catalytic Cracker On Operations for Humble

Special to NPN

HOUSTON, TEX—Humble Oil & Refining Co.'s second giant fluid catalytic cracking unit was placed in operation this week at its Baytown refinery, enabling the company to increase substantially its contribution to America's wartime demand for high-octane gasoline and synthetic rubber, H. C. Wiess, president, has announced.

Humble's Baytown refinery already holds the distinction of having produced more 100-octane gasoline and other critical petroleum war products than any other petroleum refinery.

The new "cat cracker", owned by the Humble company, towers 240 feet high, the equivalent of a 20-story building.

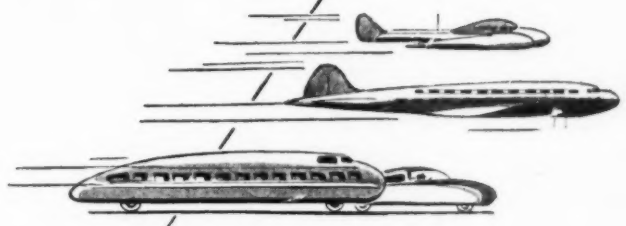
More than 18,000 barrels of raw materials per day will be charged to the new unit. Products therefrom will be used in the final manufacture of various war products and will have a decided influence on the volume of such products turned out at Baytown this year. It will make possible capacity production at the government financed butadiene plant operated by Humble and will aid materially in increasing the output of 100-octane gasoline and components.

Kansas Allowable Unchanged

WICHITA, Kans.—Kansas Corporation Commission has set total February allowable at 275,000 b/d, unchanged from January and 16,100 b/d under PAW recommendation.

The chemicals he plans today...

for the wonders of tomorrow...



will be handled safely at General American Terminals

In Tomorrow's world of plastics and electronics—there will be new liquid products undreamed of today. General American will give those liquids the same safe, fast handling for which General American Terminals are known around the world.

Make Use of These Exclusive General American Advantages

1 RELIABLE CUSTODIANSHIP. *Our warehouse receipts are highest type of collateral everywhere.*

2 SPEED WITH SAFETY. *Day and night crews eliminate delays.*

3 INDEPENDENT OWNERSHIP. *Strict privacy. We do not buy, sell, or refine oils.*

4 MODERN PROTECTION. *Latest safety appliances; lowest insurance rates; minimum evaporation losses.*

5 LARGE TANK CAR FLEET.

6 NO CONTAMINATION. *Separate pumps, lines, storage zones for dissimilar commodities.*

GATX GENERAL AMERICAN

A SYMBOL OF INTEGRITY FOR OVER 40 YEARS

GENERAL AMERICAN TANK STORAGE TERMINALS

Goodhope and Westwego, La. (*Port of New Orleans*) • Carteret, N. J. (*Port of New York*)
Corpus Christi, Texas • Galena Park, Texas (*Port of Houston*)

A Division of General American Transportation Corporation

DEAN GIVES WARNING

(*Continued from p.* 11)

ers may, under the regulations, ask their local boards to exchange just enough next period coupons for currently valid coupons to finish out the minimum drop.

Thus suppliers must not accept Period 4 or 5 coupons until Feb. 8, but they can assist their customers in trading in Period 4 and 5 coupons at the local board for coupons currently valid so that a minimum delivery may be made.

Dr. Dean said he has "given no assurance to anyone that Period 4 and 5 coupons will be validated before Feb. 8."

Three reasons necessitate keeping validity dates constant, according to OPA:

1—Last year's operating history shows that setting validity date forward causes consumption of more oil not only by people who used it in desperation, but also by those who could get along on what they had.

2—When fuel oil rationing was admitted to the coupon banking system, commitments were made that there would be no "fussing around" with period dates. Banks looked at last year's fuel rationing history and expressed reluctance to admit the fuel rationers to the program at all. They were won over only by a promise that period dates would be left alone.

3—Even if OPA could get a release from its commitment to the ration bankers, the problem of notifying cashiers and tellers in 14,000 banks would remain. No means of communication is fast enough to prevent an "administrative mess", OPA officials said.

73 and 80-Octane Are Moved Up Notch In PAW's Priorities

NPN News Bureau

WASHINGTON—PAW Jan. 31 announced placing of "higher relative priority ratings" on refining of 80-octane all-purpose military gasoline and 73-octane aviation gasoline. Refiners have been notified that these two products have been moved from Group III (third preference) to Group II (second preference and critical) in the relative priority groupings.

PAW Ickes said military requirements for 80-octane all-purpose have been increasing so rapidly that it has been necessary to give a higher priority to the fuel. Since 73-octane aviation gasoline commitments to the armed forces must be protected and since all stocks used to make this gasoline will meet the 80-octane all-purpose specification, he added, it was necessary to upgrade the rating of this product also.

Relative priority groups were set up in October, 1943, when demand for the various products required for military and essential civilian purposes had become so great that competition developed between various consumer agencies.

Establishment of three rating groups eliminated uncertainty on part of refiners as to which products are more essential and, therefore, should be made, if necessary, at expense of other products. Refiners now manufacture items in Group I first and Group II second. Those in Group III are rated above all items not listed in either Groups I or II.

Deputy PAW Davies said that in those districts where regulation of crude runs is necessary because of a short crude supply, refineries making 80-octane all-purpose or 73-octane aviation gasoline will be permitted to run crude in amounts commensurate with maximum production of the two products.

Products currently in Group I are aviation gasoline blending agents, such as alkylate, hydrocodimer, codimer for hydrogenation, B-B cut for alkylation or polymerization, toluene, butadiene, petroleum synthetics and base stocks of 91-octane or better used in blending of 100-octane aviation gasoline.

In Group II are listed 73, 87, and 91-octane number aviation gasolines, 80-octane all-purpose gasoline, select gas-oil charging stock for catalytic cracking units, micro-crystalline wax, and coke in the quantities and at the plants specified by the War Production Board.

Group III includes Diesel fuels (such as minus 60 pour point Diesel fuel for the Navy and 50-cetane Diesel fuel), aviation and heavy duty military lubricants, and industrial lubricants.

New PAW Amendments Lighten Oil Men's Paper Work

NPN News Bureau

WASHINGTON — PAW Jan. 31 issued an amended form of P-98-B, which will cut down paper work by petroleum operators. Minor amendments clarify previous provisions and simplify procedures.

Simultaneously, PAW announced issuance of an amendment to PAO 15 which increased from $3000 to $5000 the cost of an operation—job or project—which may be undertaken without getting specific authority. The revised order permits use of up to $500 worth of maintenance and repair material when carrying out jobs costing $5000 or less. Existing prohibition against construction which would result in duplication of facilities is continued in force.

Other Simplifications

Operations in natural gasoline, refining and transportation branches have been benefited by amendment to PAO 15, which becomes effective Feb. 3, and by a previous amendment to PAO-11 and companion revisions in P-98-B, which permit use of materials without authorization in projects having a total cost of $5000 or less. In this connection P-98-B permits use of Form WPB-541 (PD-1A) to obtain machinery or equipment which will be installed as part of such an operation. All form WPB-541 applications will be filed with the nearest WPB field office, PAW said.

Tells How Navy Barred Elk Hills Well In 'Forbidden' Sand

NPN News Bureau

WASHINGTON—Rear Admiral H. A. Stuart Jan. 27 outlined to the House public lands committee the formal steps taken in drafting and approving the original Navy-Standard contract in the Elk Hills reserve and described negotiations with Kern County Land Co., owner of a half section within the naval reserve, looking to a contract similar to Standard's.

Navy took possession of the land company's half-section by instituting condemnation proceedings, to prevent scheduled drilling of a well into sand Navy did not want opened up, Admiral Stuart said.

(The land in question was leased to Standard for development, he explained.) Negotiations on a contract were begun at once, however, on the understanding that condemnation would be dropped if an agreement were reached. These negotiations had almost reached successful conclusion when the "uproar" over Navy-Standard contract put a stop to them, the Admiral related.

Title Only Cleared

Contract with Standard was cleared with the Justice Department as to transfer of title to the land, Admiral Stuart recounted, but this clearance was only by the title section of the lands division, and was not concerned with the contract on its merits.

It has never been Navy's custom to clear contracts with the Justice Department, Admiral Stuart said. A "very similar" contract for Naval Petroleum Reserve No. 2, he added, has never been submitted to the attorney general and has never been called into question.

Asked if it might not have been wise, in view of important nature and public interest in Elk Hills contract, to call the Justice Department into consultation on it, Admiral Stuart said that was a question for the Secretary of Navy to decide.

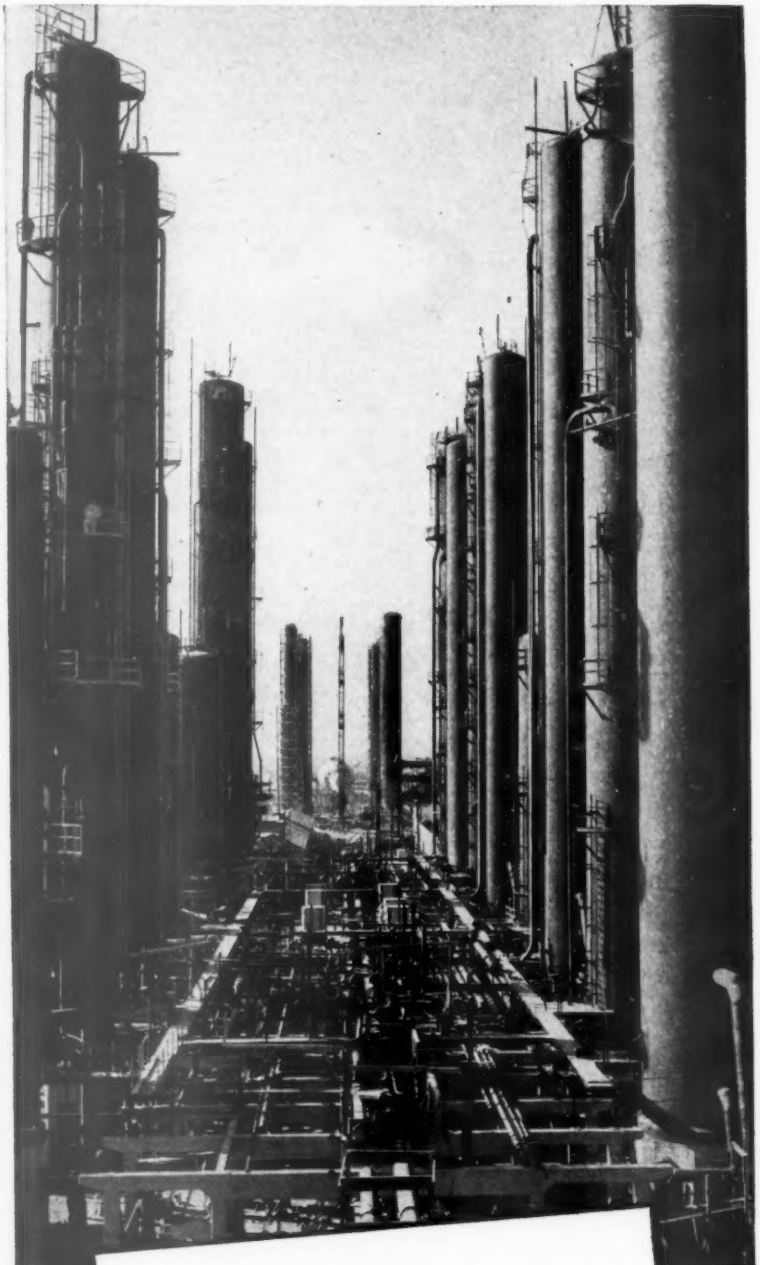
Admiral Stuart identified the Navy Department attorney who actually drafted the contract, and passed on its legality, as Phillip Buettner, senior attorney for the office of judge advocate general.

Hearing was interrupted at one point by heated interchange between Reps. White (Idaho) and Elliott (California). Rep. Elliott branded as "absolutely false and the statement of a 10-year-old child" Rep. White's statement that the Standard is "taking the oil reserves of the U. S. without paying a penny for them."

In a statement filed with the House public lands committee, Admiral Stuart disclosed that Navy had rejected the PAW request to increase production from Elk Hills Naval reserve from 15,000 to 50,000 b/d to meet increased crude demand in Dist. 5.

Admiral Stuart said that action was taken on advice of the Office of Naval Operations.

COMBINED OPERATIONS...
oilmen's style!



BUILT AND OPERATED through oil industry and Government co-operation . . . without profit . . . for the successful prosecution of the war . . . and a victorious peace.

Combined Operations is a Commando term for a fierce, concentrated attack on an objective with every available weapon.

America's oil industry has made generous use of these tactics on one war problem after another. The whole industry pitched in on the high-octane gasoline job. They teamed up against the petroleum transportation bottleneck. Now their latest use of Commando methods has made possible the development of a brand-new synthetic rubber industry.

The Government and representatives of the oil companies planned a campaign against the critical rubber situation with the oilmen supplying their pooled technical knowledge, their collective research facilities, and the best brains in their industry . . . at no cost to the Government!

And 24 months after the conception of the idea, five of the nation's leading oil companies—Atlantic, Gulf, Pure, Socony Vacuum, and Texaco—had in operation the world's largest petroleum butadiene plant, the Neches Butane Products Company.

The 110,000 long tons of synthetic rubber per year that will be made from this butadiene is a proud tribute to the fighting petroleum industry.

And to *Combined Operations!*

GULF

How much paper and paper board can we save?

THAT'S what we've all got to do to lick this problem of getting enough paper and paper board for Army and war-production use.

Every company should organize a Paper Conservation Committee.

Paper inventories must be checked with the idea of eliminating peacetime extras. From stationery to board containers, every paper item must be examined to see in what way each company can use less paper.

Functional packaging only must be the order of the day.

Every time another ship leaves an American port loaded with paper-wrapped war supplies, the problem becomes tougher. Following past government directives for paper conservation is not enough.

The War Advertising Council and the War Production Board give here a brief list of suggestions to help you. But you know your own business. You know how you can use less paper. It's up to YOU!

★ ★ ★

TO GET MORE PAPER FOR . . .	USE LESS PAPER IN THESE WAYS
Blueprints for battleships	Eliminate slack fills.
"K" ration containers	Increase units per case.
Signal Corps radio sets	Reduce separators to shoulder height.
Containers for shells	Eliminate carton liners if possible.
Gas mask canisters	Eliminate individual cartons wherever possible.
Disposable gun covers	Reduce weight of containers whenever compatible with safety.
V-mail envelopes	Do away with all unnecessary overlapping.
Blood plasma boxes	Set up a Paper Conservation Board in your plant.

★ ★ ★

This advertisement prepared under the auspices of War Advertising Council in co-operation with the Office of War Information and the War Production Board

PLATT'S WAR-OIL COMMUNICATION SERVICES

WAR ORDERS FOR INDUSTRY

(*Continued from p.* 14)

Items on Schedule A may be acquired by operators without preference ratings, including rotary rock bits and core bits. Canadian operators excluded from P-98-b's jurisdiction. Delivery orders, in most cases, no longer need PAW certification. None need be filed with Washington hereafter, but with district offices only,—one copy only, in case of orders including over $100 worth of MRO material, or where total value of order involving controlled material is under $2500, or no single item costs over $500. Casing, tubing, drill and line pipe, etc. orders must still be certified by district office before delivery order may be placed. District offices will forward to Washington orders involving materials under M-293, to expedite scheduling. All production operators, whether they drilled 40,000 feet of hole in 1942 or not, now required to file PAW-35 applications 90 days in advance of quarter in which they are to be used. Issued 1-26.

GAS FACILITIES FOR GOVERNMENT AGENCIES—SO U-1-a, as am. 1-22-44—Facilities may be extended or connected by producers to serve military agencies or Civil Aeronautics Authority if extension is not a duplication or stand-by, if cost does not exceed $1500, and no other producer can supply service with lesser amounts of critical material. Issued 1-22.

PETROLEUM INDUSTRY CONSUMERS' EXTENSION OF FACILITIES—SO U-1-h, as am. 1-22-44—Retail marketers excluded from petroleum industry consumers, who are added to the list of industrial users permitted to have installed extensions of gas and power facilities not exceeding $5000 in cost. Issued 1-22.

PRECEDENCE OF M-293 OVER CMP 1—CMP 1, Direction 45—M-293 controls in cases of conflict in scheduling provisions of CMP 1 and M-293. Issued 1-24.

MRO RATINGS UNDER P-98-b—Pri. Reg. 3, Interp. 9—When a rating assigned pursuant to Schedule B of P-98-b is applied to a purchase order for any item on Schedule B, that rating is valid, despite the fact that the item is also on List B of Pri. Reg. 3, which items are forbidden to be acquired by blanket MRO ratings. Issued 1-24.

Office of Defense Transportation

JOINT ACTION PLANS OF COMMON CARRIERS—GO ODT 3, Rev., Am. 6—Joint action plans may include plans for suspension of shipments of less-than-truckload lots between two or more points. Issued and effective 1-25.

FLEET RECORD AND REPORT REQUIREMENTS—AO ODT 9, Am. 1—Instead of separate records for each vehicle in a fleet, certificate holders may now keep integrated records for all vehicles in fleet, as well as for loads transported, and monthly rather than weekly operation records are permitted. Issued and effective 1-25.

Defense Supplies Corporation

COMPENSATION FOR CRUDE SHIPMENTS FROM DISTRICT 3 TO DISTRICT 2—DSC REG. 5—Claims should be filed with Price, Waterhouse & Co., Chicago. Amounts of compensation to be paid by DSC on rail movements of crude from West Texas to refining points in Dist. 2 set out in Schedule A. (*See NPN Jan.* 26, *p.* 22). Claims may not be filed until shipment has arrived at destination, and are to be accumulated and filed monthly. Issued 1-22-44, effective 12-4-43.

Single Movements Exempted From ODT Sanction

NPN News Bureau

WASHINGTON—ODT Jan. 27 said that a single specific movement by a private motor truck operator to a point or points not served before Oct. 25, 1943, does not constitute a new or extended operation requiring prior approval of ODT under Amendment 6 to General Order ODT 17.

Kentucky Offered Bill Boosting Truck Limit

NPN News Bureau

CHICAGO — Bill to increase axle weights of motor trucks operating on first class highways to 18,000 lbs. and truck gross weights to 40,000 lbs. was introduced before Kentucky legislature Jan. 27, according to National Highway Users Conference. The bill is sponsored by Kentucky Petroleum Industries Committee, and also provides for a single-unit length of 35 ft., maximum tractor and semi-trailer length of 45 ft., for trucks moving over first-class highways, and for 13,000 lbs. axle weight and 28,000 lbs. gross weight for those operating on second-class highways.

These provisions follow the recommendations of the Federal State Conference on War Restrictions, made at meeting of that group in Washington in May of 1942, and is supported by the Kentucky Motor Truck Assn. and approved by the Kentucky state highway commissioner. Kentucky has, at present, the most severely restrictive size and weight laws of any state in the country, National Highway Users Conference explained.

Also introduced before the Kentucky legislature with the support of the Kentucky Petroleum Industries Committee was Senate Bill 37 which proposes amendment of the state constitution to halt diversion of highway funds.

Station Shutdown No Penalty, Providence U. S. Court Says

Special to NPN

PROVIDENCE, R. I.—U. S. District Court here has ruled that service stations are a type of public utility, subject to OPA suspension when the operator's private interest "clashes with a public interest." Federal Judge Hartigan, in the first such decision in New England, held:

"Punishment or penalty in America consists in the taking of life, liberty or property. A suspension order takes neither. The dealer's personal liberty is untouched. Nothing that is really his is taken from him. His filling station is unmolested and may be used to sell things other than gasoline, and to service cars. Even his gasoline is not taken from him. He is prohibited for a brief period from distributing it or from getting any more. There is damage by the interruption of his business, but damage *absque injuria*. His private interest has merely gone into collision with a public interest, and he has had to yield."

The suit arose over OPA's closing the station of Arthur L. Means, an Amoco lessee, for alleged driving ban violations last summer. The operator's appeals were denied by OPA at Washington on the ground that Mr. Means had shown "a contemptuous and flagrant disregard" of rationing orders. Mr. Means then sought a federal restraining order, arguing that OPA's "kangaroo" courts were usurping court functions in the imposition of penalties, in violation of the Second War Powers Act.

The issue finally turned on the question whether OPA hearings are "court" procedure and whether suspension is a penalty. Judge Hartigan ruled that a suspension order is merely designed to promote national security and is not a penalty, and that an operator's financial loss through suspension is incidental to its purpose.

The court's opinion concluded:

"It is true that the OPA, like many other administrative boards and commissions, has put forth a great mass of regulations which look like legislation and has established an elaborate system of quasi-courts. We do not think a penalty has been ordained or adjudged in such a case as to require the action of Congress and a court; but that observance of rationing rules may as a matter of administration be made a condition of participation in allocation (of gasoline) and that temporary suspension is a proper enforcement of the condition."

Louisiana Held at 369,561 b/d

Special to NPN

BATON ROUGE—The Louisiana Department of Conservation has set February allowable at 369,561 b/d, a figure 460 b/d above January allowable and 6139 b/d under PAW recommendation. Allowable was split between north and south Louisiana fields in amounts of 75,731 b/d and 293,830 b/d respectively.

Coming Meetings

FEBRUARY

Illinois Petroleum Marketers' Assn., 1944 Post-War Conference, Hotel Pere Marquette, Peoria, Ill., Wed.-Thurs., Feb. 16-17.

American Institute of Mining and Metallurgical Engineers, annual meeting, Waldorf-Astoria, New York, N. Y., Sun-Thurs., Feb. 20-24.

Iowa Independent Oil Jobbers' Assn., annual meeting, Hotel Fort Des Moines, Des Moines, Ia., Wed-Thurs., Feb. 23-24.

Missouri Independent Oil Jobbers Assn., annual convention, Governor Hotel, Jefferson City, Mo., Thurs.-Fri., Feb. 24-25.

MARCH

Indiana Independent Petroleum Assn., spring convention and oil war conference, Hotel Severin, Indianapolis, Tues.-Wed., Mar. 8-9.

Empire State Petroleum Assn., Inc., spring meeting, Hotel Onondaga, Syracuse, N. Y., Wed.-Thurs., Mar. 22-23.

Western Petroleum Refiners' Assn., 32nd annual meeting, Jefferson Hotel, St. Louis, Mo., Tues., March 28.

APRIL

Natural Gasoline Assn. of America, annual meeting, Baker Hotel, Dallas, Wed.-Fri., April 12-14.

American Petroleum Institute, Eastern Division, Div. of Production, Deshler-Wallick Hotel, Columbus, Ohio, Thurs.-Fri., April 13-14.

Petroleum Industry Electric Supply Assn., annual meeting, Baker Hotel, Dallas, Tex., Wed.-Thurs., April 19-20.

Tie YOUR FUTURE *to this star*

Many things may change but the high quality of Beaver-Penn Motor Oil will never vary . . . This label on cans, glass or any other container guarantees the contents to be Freedom pedigreed, 100% Pure Pennsylvania—a product that you can always sell with the assurance that its use will back up every claim you make for it . . . A few exclusive territories are now open; write for details.

FREEDOM OIL COMPANY • FREEDOM, PENNA.

PACIFIC COAST BULK PLANT AND WAREHOUSE
Los Angeles, California

Market Reports

ATLANTIC COAST — Suppliers of East Coast points report markets steady and available supplies low. Kerosine and No. 2 fuel oil reported critically tight with demand for materials in excess of inventories. Shipments of gasoline in New York harbor limited, and many marketers report living mainly off allocations. No price changes reported.

* * *

MID-WEST — Refiners last week saw no letup in any product but heating oils which eased somewhat the latter part of the week, because of mild weather. Refiners and marketers expressed bewilderment over degree of strength of gasoline markets, some attributing it to extravagant black market operations. Many have practically exhausted all inventories of gasoline and spring farm demand will find them with no stocks on hand. Smaller refiners are working on daily production.

Residual oil and lubricating oil demand showed no letup last week but stocks are in fairly good condition, according to refiners and marketers. Kerosine, range oil and No. 1 prime white were exceptionally short and orders often had to be held for a week before material was available to fill them. Transportation continued to be most important factor in filling of orders. Prices were unchanged.

* * *

PENNSYLVANIA — Western Penna. refiner reported advancing his quotations 1c for 200 vis. and 150 vis. 25 p.t. neutrals to 30c and 28c, respectively. Others continue to quote 200 vis. as follows: One at 28c, two at 30c, two at 31c, one at 32c and one at 32.5c. Price ranges remained at 28-32.5c for 200 vis. and 26-30.5c for 150 vis. 25 p.t. Many refiners reported only limited quantity of neutral oils for sale to regular trade.

Continued shortage of everything, with long lists of standing orders was general report. Kerosine and light fuels still in strong demand but very little available in either field. One refiner in other districts said he raised his quotation 0.25c for 47 w.w. kerosine to 7.5c and withdrew quotations of 6.5c for No. 3 and 36-40 gravity fuel because he had none to sell. Price ranges for all products remained unchanged.

* * *

MID-CONTINENT — Only refiner quoting on 62 oct. gasoline in Arkansas market withdrew his posting of 5.5c since he is no longer making the grade. No other quotation changes were reported.

Texas refiner reported open spot sale of 100,000 bbls. 21 grav. residual fuel oil at $1.21 for immediate shipment in seller's cars to Atlantic Coast.

Refiners continue to report heavy demand for gasoline giving them little opportunity to accumulate any storage against spring demand. Transport truck situation is becoming acute and tank cars "tight". Demand for kerosine is very strong; many say they are trying to buy from other refiners with little luck. Several refiners reported railroads are asking for more residual fuel but only half of them said they would be able to help them.

Twenty-five cars Grade 26-70 natural gasoline were reported sold at 4.75c f.o.b. Group 3, and 10 cars were reported sold at 4.375c f.o.b. Breckenridge.

* * *

GULF COAST—Critical shortage of kerosine reported by Gulf Coast refiners as inquiries for materials "pour in". Gasoline is likewise reported dangerously low. Refiner quoting 4.125c on 42-44 kerosine in tank car and barge lots withdrew his quotation leaving one other quoting this price. Same refiner re-entered the market on 72 oct. gasoline quoting 5.75c in tank car and barges. Price range is unaffected. No other changes reported.

* * *

CALIFORNIA — Gasoline prices remain at ceilings. Some independent refiners still quote third structure gasoline but for all practical purposes it has disappeared from the market. Bottom of range for regular and Ethyl is 6.5c and 7c.

Lifting of retail prices by independent and rebrand service stations has been notable in Los Angeles area. Practically all retailers are up to or pushing major company prices. Fuel oil remains at $1.10 ceiling and market is as tight or tighter than gasoline.

CRUDE PRICES

Since changes in crude oil prices are so few, the 2 pages of crude oil price tables hereafter will be printed only when there are sufficient changes in prices to warrant.

In the meantime a record is being kept in the Cleveland office of NPN and OILGRAM from which the publishers will be glad to make proofs, or letters or affidavits as to what the prices are, and without charge to regular subscribers. Changes in crude oil prices will be specially noted in this market section when made.

Crude Price Changes

(No changes reported during week ended Jan. 31. For latest tables of crude prices see NPN Jan. 26, pages 53, 54. Also see notice of changes Jan. 5, p. 43.)

Summary of Daily Gasoline Prices (January 24 to January 31)

	Monday Jan. 31	Friday Jan. 28	Thursday Jan. 27	Wednesday Jan. 26	Tuesday Jan. 25
U. S. Motor (ASTM octane)					
76 octane Ethyl:					
Oklahoma	6.75	6.75	6.75	6.75	6.75
Mid-Western (Group 3 basis)	6.75 - 7.25	6.75 - 7.25	6.75 - 7.25	6.75 - 7.25	7
N. Tex. (For shpt. to Tex. & N. M. dest'ns.)	7	7	7	7	7
W. Tex. (For shpt. to Tex. & N. M. dest'ns.)	6.75 - 7 (2)	7 (2)	7 (2)	7 (2)	7 (2)
72 octane:					
Oklahoma	6	6	6	6	6
Mid-Western (Group 3 basis)	6	6	6	6	6
N. Tex. (For shpt. to Tex. & N. M. dest'ns.)	6	6	6	6	6
W. Tex. (For shpt. to Tex. & N. M. dest'ns.)	6	6	6	6	6
63-66 octane:					
Oklahoma	5.625 (2)	5.625 (2)	5.625 (2)	5.625 (2)	5.625 (2)
Mid-Western (Group 3 basis)	5.6 - 5.625	5.6 - 5.625	5.6 - 5.625	5.6 - 5.625	5.6 - 5.625
N. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.625 (1)	5.625 (2)	5.625 (2)	5.625 (2)	5.625 (2)
W. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.75 (1)	5.75 (1)	5.75 (1)	5.75 (1)	5.75 (1)
60 octane & above:					
Oklahoma	5.25	5.25	5.25	5.25	5.25
Mid-Western (Group 3 basis)	5.2 - 5.25	5.2 - 5.25	5.2 - 5.25	5.2 - 5.25	5.2 - 5.25
N. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.2 - 5.25	5.2 - 5.25	5.2 - 5.25	5.2 - 5.25	5.2 - 5.25
W. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.25	5.25	5.25	5.25	5.25
Motor Gasoline, 72 octane (ASTM)					
New York harbor	9.2 - 9.4	9.2 - 9.4	9.2 - 9.4	9.2 - 9.4	9.2 - 9.4
New York harbor, barges	9.1 - 9.3	9.1 - 9.3	9.1 - 9.3	9.1 - 9.3	9 1 - 9.3
Philadelphia district	9.2	9.2 - 9.7	9.2 - 9.7	9.2 - 9.7	9.2 - 9.7
Baltimore district	8.95	8.95	8.95	8.95	8.95
Motor Gasoline:					
Western Penna. Bradford-Warren:					
"Q" Gasoline, Min. 70 Oct. (ASTM)	7.75 - 8.95	7.75 - 8.95	7.75 - 8.95	7.75 - 8.95	7.75 - 8.96
Western Penna. Other Districts:					
"Q" Gasoline, Min. 70 Oct. (ASTM)	7.5 - 8.45	7.5 - 8.45	7.5 - 7.75	7.5 - 7.75	7.5 - 7.75

Refinery Operations

(American Petroleum Institute figures in thousands of barrels of 42 gal. each. Figures include reported totals plus estimate of unreported amounts and are therefore on a Bureau of Mines basis.)

Districts	Daily Potential Refining Capacity Week Ended Jan. 22	Daily Potential Refining Capacity Week Ended Jan. 15	Per Cent of Refining Capacity Reporting Week Ended Jan. 22	Per Cent of Refining Capacity Reporting Week Ended Jan. 15	Daily Average Crude Runs to Stills Week Ended Jan. 22	Daily Average Crude Runs to Stills Week Ended Jan. 15	Per Cent of Reporting Capacity Operated Week Ended Jan. 22	Per Cent of Reporting Capacity Operated Week Ended Jan. 15
Combined**	2,448	2,448	89.5	89.0	2,120	2,049	86.6	83.7
Appalachian (Dist. No. 1)	130	130	83.9	83.9	99	105	76.2	80.8
Appalachian (Dist. No. 2)	47	47	87.2	87.2	50	55	106.4	117.0
Ind., Ill., Ky.	824	824	85.2	85.2	789	757	95.8	91.9
Okla., Kans., Mo.	416	416	80.1	80.1	377	359	90.6	86.3
Rocky Mt. (Dist. No. 3)	8	8	26.9	26.9	11	11	137.5	137.5
Rocky Mt. (Dist. No. 4)	141	141	58.3	58.3	103	101	73.0	71.6
California	817	817	89.9	89.9	819	766	100.2	93.8
Total U. S.—B. of M. Basis	4,831	4,831	86.8	86.6	4,368	4,203	90.4	87.0
U. S.—B. of M. Basis Jan. 23, 1943					3,555			

Districts	Gasoline Production at Refineries inc. Natural Blended Week Ended Jan. 22	Gasoline Production at Refineries inc. Natural Blended Week Ended Jan. 15	Stocks of Finished and Unfinished Gasoline Week Ended Jan. 22	Stocks of Finished and Unfinished Gasoline Week Ended Jan. 15	Total Stocks Gas Oil & Distillates Week Ended Jan. 22	Total Stocks Gas Oil & Distillates Week Ended Jan. 15	Total Stocks Residual Fuel Oil Week Ended Jan. 22	Total Stocks Residual Fuel Oil Week Ended Jan. 15
Combined**	6,037	5,792	36,039	35,506	19,373	19,543	15,535	16,150
Appalachian (Dist. No. 1)	361	340	1,860	1,786	850	906	157	171
Appalachian Dist. No. 2)	173	174	1,113	1,101	68	92	176	174
Ind., Ill., Ky.	2,691	2,624	16,456	16,244	5,531	5,805	3,141	3,129
Okla., Kans., Mo.	1,273	1,361	7,494	7,186	1,753	1,874	1,086	1,083
Rocky Mt. (Dist. No. 3)	33	39	74	75	20	20	28	29
Rocky Mt. (Dist. No. 4)	301	294	1,511	1,511	366	355	584	602
California	2,076	2,058	15,216	14,996	10,335	10,504	32,724	33,191
Total U. S.—B. of M. Basis	12,945	12,682	79,763*	78,557‡	38,296	39,925‡	53,431	54,327†
U. S.—B. of M. Basis Jan. 23, 1943	9,930		86,086		40,303		71,689	

*Finished 68,891,000 bbl.; Unfinished 10,872,000 bbl.

**Includes East Coast, Inland Texas, Texas Gulf, Louisiana Gulf, and North Louisiana-Arkansas districts.

‡Combined area revised account inclusion of stocks not previously reported. Add to finished gasoline stocks, Jan. 15, 152,000 bbls.; Jan. 8, 152,000; Jan. 1, 150,000; Dec. 25, 129,000; Dec. 18, 23,000. Add to Gas Oil and Distillates: Jan. 15, 826,000; Jan. 8, 580,000; Jan. 1, 297,000.

†Revised in California due to error by reporting company.

Dist. No. 1 inventory indices are: Gasoline, 41.9%; Kerosine, 45.3%; Gas, Oil & Distillate, 87.3%; Residual Fuel, 67.9% of normal.

U. S. Crude Oil Production

(American Petroleum Institute figures)

	WEEK ENDED Jan. 22 Barrels (Daily Average)	WEEK ENDED Jan. 15 Barrels (Daily Average)
Oklahoma	329,800	318,800
Kansas	281,050	273,600
Nebraska	1,500	1,300
Texas	1,899,650	1,899,650
Louisiana	358,400	358,200
Arkansas	78,400	79,700
Mississippi	45,700	46,750
Illinois	204,700	206,800
Indiana	12,650	12,150
Eastern (Ill., Ind. & Ky. excluded)	71,300	69,150
Kentucky	22,450	23,550
Michigan	51,600	57,100
Wyoming	90,600	87,800
Montana	21,100	21,100
Colorado	7,500	7,800
New Mexico	113,100	112,900
California	799,700	796,200
Total, U. S.	4,389,200	4,372,550

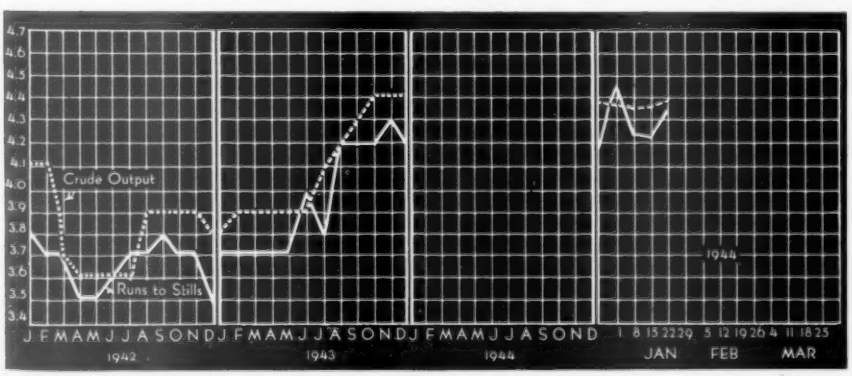
Crude Oil Stocks

(Bureau of Mines Figures in thousands of bbls.)

Grade or Origin	Jan. 22	Jan. 15	Change
Penna. Grade	2,353	2,367	— 14
Other Appalachian	1,411	1,523	—112
Lima-Michigan	871	951	— 80
Illinois-Indiana	12,390	12,363	+ 27
Arkansas	2,920	3,006	— 86
Kansas	7,560	7,529	+ 31
Louisiana	14,610	14,723	—113
Northern	4,545	4,705	—160
Gulf Coast	10,065	10,018	+ 47
Mississippi	1,053	1,069	— 16
New Mexico	7,380	7,140	+240
Oklahoma	32,643	32,614	+ 29
Texas:	113,120	112,063	+1,057
East Texas	23,121	23,198	— 77
West Texas	28,215	28,153	+ 62
Gulf Texas	34,943	34,210	+733
Other Texas	26,841	26,502	+339
Panhandle	6,444	6,528	— 84
North	5,347	5,188	+159
South	5,696	5,664	+ 32
Other	9,354	9,122	+232
Rocky Mountain	10,985	11,093	—108
California	29,993	30,341	—348
Foreign	1,525	1,366	+159
Total gasoline-bearing in U. S.	238,814	238,148	+666
Heavy in California	7,816	8,098	—282

Crude Production & Runs to Stills

(Millions of Barrels)


Crude Output
Runs to Stills
1944
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D 1 8 15 22 29 5 12 19 26 4 11 18 25
1942
1943
1944
JAN
FEB
MAR

N.P.N. Gasoline Index

	Dealer T.W. Cents Per Gal.	Tank Car Cents Per Gal.
Jan. 31	10.43	6.66
Month ago	10.43	6.64
Year ago	10.33	6.70

Dealer index is an average of "undivided" dealer prices, ex-tax, in 50 cities.

Tank car index is weighted average of following wholesale markets for regular-grade gasoline, FOB refineries or terminals: Okla., Mid-Western, W. Penna., Calif., N. Y. Harbor, Philadelphia, Jacksonville, Boston and Gulf Coast.

Pennsylvania Crude Runs

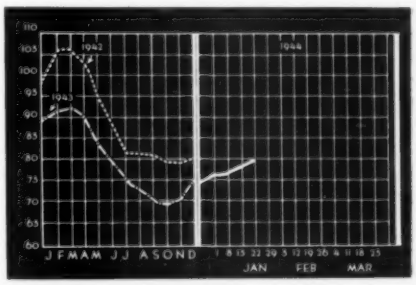
(Compiled by National Petroleum Assn. from reports of all companies refining Pennsylvania crude. Figures in bbls.)

DAILY AVERAGE

Week Ended Jan. 22, 1944	Week Ended Jan. 15, 1944	Week Ended Jan. 23, 1943
68,732	73,395	77,551

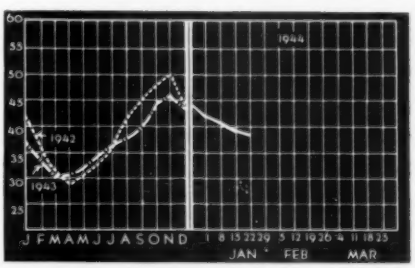
Gasoline Stocks

(Millions of Barrels)



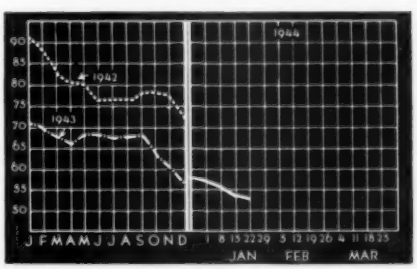
Gas Oil & Distillate Stocks

(Millions of Barrels)



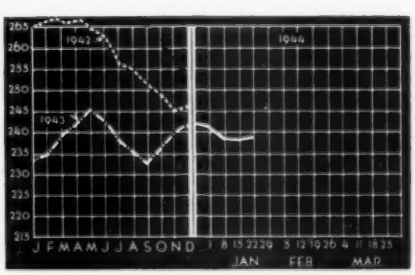
Residual Fuel Oil Stocks

(Millions of Barrels)



Crude Oil Stocks

(Millions of Barrels)



OIL PRICE SECTION ★ At Refineries and Terminals and by Tank Wagon

Prices herewith are reproduced from Platt's *OILGRAM* Daily Oil Price Service, associated with National Petroleum News, whose representatives in all *NPN-OILGRAM* offices devote their time exclusively to reporting oil industry prices everywhere.

Prices shown are actual sales prices, or quotations meaning sellers' general offers or posted prices; for current sales and shipment; for the business day or period stated; except Tank Wagon prices, prices are for bulk lots such as tank car and motor transport; barge or tanker cargo lot prices are identified; FOB refineries or terminals; in cents per gal. except where shown in bbls. of 42 gals.; ex all fees and taxes; for crude oil and its products lawfully produced and transported; reported as received by *OILGRAM* and National Petroleum News but not guaranteed; for subscribers' private use only and not for resale or distribution or publication. For further details of price conditions apply to any *NPN-OILGRAM* office or see back of any *OILGRAM* Price Service invoice.

For complete price service delivered daily from nearest *OILGRAM* publishing office, New York, Cleveland and Tulsa, Okla. address Platt's *OILGRAM*, 1213 W. 3rd St., Cleveland (13), Ohio. Annual subscription rate payable in advance $100 a year via train mail and $125 per year via air mail.

Refinery Prices

Gasoline —U. S. Motor (A S T M) except where otherwise specified

Prices in Effect	Jan. 31	Jan. 24
OKLAHOMA		
76 oct. Ethyl...	6.75	6.75
72 oct.....	6	6
63-66 oct.....	5.625 (2)	5.625 (2)
60 oct. & below..	5.25	5.25
60-62, 400 e.p...	5.25 (1)	5.25 (1)
MID-WESTERN (Group 3 basis)		
76 oct. Ethyl...	6.75 – 7.25	6.75 – 7.25
72 oct.....	6	6
63-66 oct.....	5.6 – 5.625	5.6 – 5.625
60 oct. & below..	5.2 – 5.25	5.2 – 5.25
N. TEX. (For shpt. to Tex. & N. M. dest'ns.)		
76 oct. Ethyl...	7	7
72 oct.....	6	6
63-66 oct.....	5.625 (1)	5.625 (1)
60 oct. & below..	5.2 – 5.25	5.2 – 5.25
60-62, 400 e.p...	5.375 (1)	5.375 (1)
W. TEX. (For shpt. to Tex. & N. M. dest'ns.)		
76 oct. Ethyl...	6.75 – 7 (2)	6.75 – 7 (2)
72 oct.....	6	6
63-66 oct.....	5.75 (1)	5.75 (1)
60 oct. & below..	5.25	5.25
CENT. W. TEX. (Prices to truck transports)		
76 oct.....	7 (2)	7 (2)
72 oct.....	6 (2)	6 (2)
67-69 oct.....	....	....
62 oct. & below..	5.25 (2)	5.25 (2)
AMARILLO, TEX. (For shpt. to W. Okla. & Tex. differential territory.)		
60 oct. & below.	No Price	No Price
60-62, 400 e.p...	No Price	No Price
KANSAS (For Kansas destinations only)		
76 oct. Ethyl...	7.25-7.5 (2)	7.25-7.5 (2)
72 oct.....	6.25 – 6.3	6.25 – 6.3
63-66 oct.....	5.9 (2)	5.9 (2)
60 oct. & below.	5.5	5.5
ARK. (For shipment to Ark. & La.)		
76 oct. Ethyl...	7 (1)	7 (1)
72 oct., leaded..	6 (1)	6 (1)
70-72 oct. "	5.875 (1)	5.875 (1)
62 oct. "	5.5 (1)	5.5 (1)
60 oct. & below, leaded.....	5.25 (1)	5.25 (1)
WESTERN PENNA. (Motor gasoline)		
Bradford-Warren:		
"Q" Gasoline, Min. 70 Oct. (ASTM)	7.75 – 8.95	7.75 – 8.95
Other districts:		
"Q" Gasoline, Min. 70 Oct. (ASTM)	7.5 – 8.45	7.5 – 8.45
CENTRAL MICHIGAN (FOB Central Mich. refinery group basis for shpt. within Mich.; shpts. may originate at plants outside Central group.)		
U.S. Motor: (Oct. ASTM):		
72 oct.....	8 – 8.5	8 – 8.5
67-69 oct.....	....	....
Str. run gasoline, excluding Detroit shpt.....	6	6
OHIO (S. O. Ohio quotations for statewide delivery and subject to exceptions for local price disturbances).		
72 oct.....	8.375	8.375
CALIFORNIA U.S. Motor:		
76 oct. (Ethyl)....	7.5 – 8.75	7.5 – 8.75
70-72 oct. (regular)	6.5 – 7.75	6.5 – 7.75
65 oct. & below (3rd grade).....	6.5 – 6.75	6.5 – 6.75

Kerosine, & Gas Fuel Oils

Prices in Effect	Jan. 31	Jan. 24
OKLAHOMA		
41-43 grav. w.w...	4.375	4.375
42-44 grav. w.w...	4.5,(1)	4.5 (1)
Range Oil.....	4	4
No. 1 P.W.....	3.875	3.875
No. 1 straw.....	....	....
No. 2 straw.....	3.625	3.625
No. 3 fuel.....	3.5 (2)	3.5 (2)
U. G. I. Gas Oil...	....	....
No. 6 fuel.....	....	....
14-16 fuel.....	$0.97 (2)	$0.97 (2)
MID-WESTERN (Group 3 basis)		
41-43 grav. w.w...	4.375	4.375
42-44 grav. w.w...	4.5	4.5
Range Oil.....	4 – 4.1	4 – 4.1
No. 1 p.w.....	3.875	3.875
No. 2 straw.....	3.625	3.625
No. 3.....	3.5 (1)	3.5 (1)
No. 5.....	$0.85 (1)	$0.85 (1)
No. 6.....	$0.80 (2)	$0.80 (2)
N. TEX. (For shpt. to Tex. & N. M. dest'ns.)		
41-43 grav. w.w...	4.375	4.375
42-44 grav. w.w...	....	....
No. 1 P.W.....	3.875 (1)	3.875 (1)
AMARILLO, TEX. (For shpt. to W. Okla. & Tex. differential territory.)		
42-44 grav. w.w...	4.5 (1)	4.5 (1)
No. 1 straw.....	No Price	No Price
KANSAS (For Kansas destinations only).		
41-43 grav. w.w...	No Price	No Price
42-44 grav. w.w...	4.625– 4.7	4.625– 4.7
No. 1 p.w.....	4 – 4.1	4 – 4.1
No. 6 fuel.....	$0.85	$0.85
ARK. (For shipment to Ark. and La.)		
41-43 grav. w.w...	....	....
42-44 w.w. kero...	4.5 (1)	4.5 (1)
No. 1.....	4 (1)	4 (1)
No. 2.....	3.625 (1)	3.625 (1)
No. 3 fuel.....	3.5 (1)	3.5 (1)
Tractor fuel, for shpt. to Ark. points only.....	5.125 (1)	5.125 (1)
Diesel fuel 52 & below.....	4 (1)	4 (1)
Diesel fuel 58 & above.....	4.25 (1)	4.25 (1)
WESTERN PENNA.		
Bradford-Warren:		
45 grav. w.w.....	6.55 – 8.05	6.55 – 8.05
46 grav. w.w.....	6.675 (1)	6.675 (1)
No. 1 fuel.....	6.55 – 8.05	6.55 – 8.05
No. 2 " .....6.625-7.625(2)		6.625–7.625(2)
No. 3 " 6.625–7.75 (2)		6.625–7.75 (2)
36-40 gravity.... 6.625–6.75 (2)		6.625–6.75 (2)
Other districts:		
45 grav. w.w.....	7 – 7.925	7 – 7.925
46 grav. w.w.....	7 – 7.625	7 – 7.625
47 grav. w.w.....	7.05 – 7.875	7.05 – 7.875
No. 1 fuel.....	6.75 – 7.375	6.75 – 7.375
No. 2 "	6.125– 7.375	6.125– 7.375
No. 3 "	6.5 – 7.375	6.5 – 7.375
36-40 grav. Pittsburgh dist. prices excluded.....	6.5 – 7.375	6.5 – 7.375
CENTRAL MICHIGAN (FOB Central Mich. refinery group basis for shpt. within Mich.; shpts. may originate at plants outside Central group.)		
47-49 gravity w.w.	5.8 – 6	5.8 – 6
P.W. Distillate...	5.5	5.5
No. 3 gas oil, Straw	5	5
U.G.I. gas oil.....	4.5 (2)	4.5 (2)
Fuel Oils (*Vis. at* 100).		
300-500 Vis.....	....	....
100-300 Vis.....	4.5	4.5
OHIO (S. O. quotations for statewide delivery)		
Kerosine.....	7	7
CALIFORNIA		
40-43 grav. w.w...	5 – 7	5 – 7
San Joaquin Valley:		
Heavy fuel.....	$1.10 (2)	$1.10 (2)
Light fuel.....	$1.20 (2)	$1.20 (2)
Diesel fuel.....	4 (2)	4 (2)
Stove dist.....	5 (2)	5 (2)
Los Angeles:		
Heavy fuel.....	$1.10 (2)	$1.10 (2)
Light fuel.....	$1.20 (2)	$1.20 (2)
Diesel fuel.....	4 (2)	4 (2)
Stove dist.....	5	5
San Francisco:		
Heavy fuel.....	$1.15 (1)	$1.15 (1)
Light fuel.....	$1.25 (1)	$1.25 (1)
Diesel fuel.....	4.5 (1)	4.5 (1)
Stove dist.....	5.5 (1)	5.5 (1)

NOTE: All above heavy fuels meet Pacific specification 400; light fuel, spec. 300; Diesel fuels, spec. 200; and stove distillate, spec. 100.

Lubricating Oils

Prices in Effect	Jan. 31	Jan. 24
WESTERN PENNA.		
Prices are for sales made, or offers reliably reported, to jobbers & compounders only.		
Viscous Neutrals—*No. 3 col. Vis. at 70°F.*		
200 Vis. (180 at 100°) 420-425 fl.		
0 p.t.....	35 (1)	35 (1)
10 p.t.....	34 (1)	34 (1)
15 p.t.....	33 (1)	33 (1)
25 p.t.....	28–32.5	28–32.5
150 Vis. (143 at 100°) 400-405 fl.		
0 p.t.....	33 (1)	33 (1)
10 p.t.....	32 (1)	32 (1)
15 p.t.....	31 (1)	31 (1)
25 p.t.....	26–30.5	26–30.5
Cylinder Stocks		
Brt. stk., 145-155 *vis. at* 210°, 540-550 fl., *No. 8 col.*		
10 p.t.....	30.5 (1)	30.5 (1)
15 p.t.....	29.5 (1)	29.5 (1)
25 p.t.....	25	25
600 S.R. filterable.	15	15
650 S.R.....	15.5	15.5
600 fl.....	16	16
630 fl.....	17	17
MID-CONTINENT (F. o. b. Tulsa)		
Neutral Oils (*Vis. at* 100° *F. 0 to* 10 *P.P.*)		
Pale Oils:		
Vis. Color		
60-85—No. 2....	8	8
86-110—No. 2...	8.5	8.5
150—No. 3.....	14.5	14.5
180—No. 3.....	15	15
200—No. 3.....	15	15
250—No. 3.....	16–16.5	16–16.5
280—No. 3.....	17	17
300—No. 3.....	18	18
Red Oils:		
180—No. 5.....	15 (1)	15 (1)
200—No. 5.....	15 (1)	15 (1)
280—No. 5.....	No Price	No Price
300—No. 5.....	17.5 (2)	17.5 (2)
Note: Viscous Neutrals, 15-25 p.p. generally are quoted 0.5c under 0-10 p.p. oils. Non-viscous oils, 15-25 p.p.; generally are quoted 0.25c under 0-10 p.p. oils.		
Bright Stock—*Vis. at* 210°		
200 Vis. D.....	27 (1)	27 (1)
150-160 Vis. D: 0 to 10 p.p.....	23	23
10 to 25 p.p.....	22.5–23	22.5–23
25 to 40 p.p.....	23 (1)	23 (1)
150-160 Vis. E....	22 (1)	22 (1)
120 Vis. D: 0 to 10 p.p.....	22 (2)	22 (2)
600 S.R. Dark Green.....	8.5 (1)	8.5 (1)
600 S.R. Olive Green.....	10–11 (2)	10–11 (2)
631 S.R.....	....	....
Black Oil.....	5.5 (1)	5.5 (1)

QUALIFYING PRICE NOTE: Prices on neutrals are posted prices from which refiners allow special discounts, ranging to 1c to meet varying local competition.

SOUTH TEXAS Neutral Oils		
Pale Oils (*Vis. at* 100°*F.*)		
Vis. Color		
100 No. 1½-2½.	6.5	6.5 (2)
200 No. 2-3.....	8.75	8.75
300 No. 2-3.....	9.25	9.25
500 No. 2½-3½..	10	10
750 No. 3-4.....	10.25	10.25
1200 No. 3-4.....	10.375	10.375
2000 No. 4.....	10.5	10.5

(Continued on next page)

NOTE—Parenthetical figures after prices indicate number of companies quoting when less than three companies are quoting.

NOTICE—Owing to great demand, refiners generally limit quotations to regular customers and refuse bids, though higher, from others. Refiners' prices and sales shown) bids reported in market leads.

Refinery Prices (Continued)

Prices in Effect	Jan. 31	Jan. 24
Red Oils:		
100 No. 5-6	6.5 (2)	6.5 (2)
200 No. 5-6	8.75	8.75
300 No. 5-6	9.25	9.25
500 No. 5-6	10	10
750 No. 5-6	10.25	10.25
1200 No. 5-6	10 375	10.375
2000 No. 5-6	10.5	10.5

CHICAGO (From Mid-Continent p.l. crude.) Neutral oils *sis. at* 100° *F. 0 to* 10 *p. p.*

Pale Oils Vis. Color		
60-85—No. 2	9.5 (1)	9.5 (1)
86-110—No. 2	10 (1)	10 (1)
150—No. 3	15.5 (1)	15.5 (1)
180—No. 3	16 (1)	16 (1)
200—No. 3	16 (1)	16 (1)
250—No. 3	17 (1)	17 (1)
Red Oils:		
180—No. 5	16 (1)	16 (1)
200—No. 5	16 (1)	16 (1)
250—No. 5	17 (1)	17 (1)
280—No. 5	18 (1)	18 (1)
300—No. 5	18.5 (1)	18.5 (1)

Note: Viscous oils, 15 to 30 p.p. are quoted 0.5c lower: 60-85 and 86-110 No. 2 non-viscous oils, 15 to 30 p.p., 0.25c lower.

Unfiltered Steam Refined: (*Viscosity at* 210°)

140	11.5 (1)	11.5 (1)
160	12.5 (1)	12.5 (1)
200	13.5 (1)	13.5 (1)

Bright stocks, 160 *vis. at* 210 *No.* 8 *color:*

0 to 10 p.p.	24 (1)	24 (1)
15 to 25 p.p.	23 5 (1)	23.5 (1)
30 to 40 p.p.	21.5 (1)	21.5 (1)
E filtered Cyl. Stock	15.5 (1)	15.5 (1)

Note: To obtain prices delivered in Chicago, add 0.25c per gal.

Natural Gasoline

(Group 3 & Breckenridge prices are to blenders on freight basis shown below. Shipments may originate in any Mid-Continent manufacturing district.)

FOB GROUP 3

Grade 26-70 ..... 4.75 (Sale) 4.75 (Sale)

FOB BRECKENRIDGE

Grade 26-70 .....4.375 (Quote) 4.375 (Quote)

CALIFORNIA (FOB plants in Los Angeles basin)

21 pound vapor pressure for blending .... 4.75– 5.375 4.75 – 5.375

Naphtha and Solvent

(*FOB Group* 3)		
Stoddard solvent	6.625	6.625
Cleaners' naphtha	7.125	7.125
V.M.&P. naphtha	7.1 – 7.125	7.1 – 7.125
Mineral spirits	6.1 – 6.125	6.1 – 6.125
Rubber solvent	7.1 – 7.125	7.1 – 7.125
Lacquer diluent	7.375– 8.125	7.375– 8.125
Benzol Diluent	8.375– 8.625	8.375– 8.625
WESTERN PENNA.		
Bradford-Warren District:		
Stoddard Solvent	7.5 (1)	7.5 (1)
Other Districts:		
Untreated naphtha	7 – 7.25	7 – 7.25
Stoddard solvent	7.25 – 7.75	7.25 – 7.75

OHIO (S. O. quotations for statewide delivery):

V.M.&P. naphtha, D.C. naphtha, Varnolene & Sohio solvent	10	10
Rubber solvent	9	9

Wax

WESTERN PENNA. (Bbls. C.L.)

White Crude Scale:		
122-124 A.m.p.	4.25 (2)	4.25 (2)
124-126 A.m.p.	4.25	4.25

OKLAHOMA (C.L. FOB Refinery)

Semi-refined:		
128 AMP min., white, 50 kilo bags	No Price	No Price
132-134 AMP, bbls.	5.25 (1)	5.25 (1)

CHICAGO (FOB Chicago district refinery of one refiner, in bags, carloads. Carloads, slabs loose 0.4c less. Melting points are EMP (ASTM) methods; add 3° to convert into AMP.)

Fully refined:		
122-124 (bags only)	5.6	5.6
125-127	6	6
127-129	6.25	6.25
130-132	6.55	6.55
132-134	6.8	6.8
135-137	7.55	7.55

Petrolatums

WESTERN PENNA. (Bbls., carloads; tank cars, 0.5c per lb. less.)		
Snow White	6.125– 7.25	6.125– 7.25
Lily White	5.375– 6.25	5 375– 6.25
Cream White	4.375– 5.5	4.375– 5.5
Light Amber	3.375– 4	3 375– 4
Amber	3.125– 3.75	3.125– 3.75
Red	3 – 3.5	3 – 3.5

Tank Wagon Prices

Commercial or consumer tank car, tank wagon, dealer, and service station prices for gasoline **do not include taxes;** *they do, however, include inspection fees as shown in general footnote. Gasoline taxes, shown in separate column, include 1.5c federal, and state taxes; also city and county taxes as indicated in footnotes. Kerosine tank wagon prices also do not include taxes; kerosine taxes where levied are indicated in footnotes. Dealer discounts are shown in footnotes. These prices in effect Jan. 31, 1944 as posted by principal marketing companies at their headquarters offices, but subject to later correction.*

S. O. N. J.

Esso (*Regular Grade*)	Consumer Tank Wagon	Dealer T.W.	Gasoline Taxes	Kerosine T.W.
*Atlantic City, N. J.	10.2	10.7	4.5	10
*Newark, N. J.	10.2	10.7	4.5	10
Annapolis, Md.	10.55	11.05	5.5	....
Baltimore, Md.	9.95	10.45	5.5	10.8
Cumberland, Md.	11.35	11.85	5.5	12.3
Washington, D. C.	10.2	10.7	4.5	11.3
Danville, Va	11.65	12.15	6.5	12.55
Norfolk, Va	10.45	10.95	6.5	12.3
Petersburg, Va	10.75	11.25	6.5	13.3
Richmond, Va	10.75	11.25	6.5	13.3
Roanoke, Va	11.95	12.45	6.5	12.8
Charleston, W. Va.	12.25	12.75	6.5	13.6
Parkersburg, W. Va.	11.55	12.05	6.5	13.3
Wheeling, W. Va.	11.55	12.05	6.5	13.9
Charlotte, N. C.	12.1	12.6	7.5	11.6
Hickory, N. C.	12.65	13.15	7.5	12.6
Mt. Airy, N. C.	12.5	13.0	7.5	11.8
Raleigh, N. C.	11.85	12.35	7.5	12.6
Salisbury, N. C.	12.15	12.65	7.5	13.0
Charleston, S. C.	10.95	11.45	7.5	....
Columbia, S. C.	11.8	12.3	7.5	....
Spartanburg, S. C.	12.5	13.0	7.5	....

	Mineral Spirits T.W.	V.M.&P. T.W.
Newark, N. J.	13	14.5
Baltimore, Md.	15.5	....
Washington, D. C.	15.5	....

Fuel Oils—T.W.	No. 1	No. 2	No. 3
Atlantic City, N. J.	10	9	9
Newark	10	9	9
Annapolis, Md.	...	...	...
Baltimore	9.8	9	9
Washington, D. C.	10.3	9.4	9.4
Norfolk, Va	10	8.8	8.8
Petersburg	10.3	9	...
Richmond	10.3	9	9
Charlotte, N. C.	10.6	10.4	...
Hickory, N. C.	....	10	...
Raleigh	11.6	10.1	...
Charleston, S. C.	....	9	...
Columbia	....	10	...
Spartanburg	....	10.8	...

*Effective Aug. 5, '42 minimum retail resale price of 14.2c posted thru New Jersey. Discounts;

Esso gasoline—to undivided dealers, 0.5c off dealer t.w.

Kerosine—1c off t.w. price for 25 gals. or more, under contract thru territory (Baltimore city contract not necessary) except no discount in state of New Jersey.

Naphthas—To buyers taking following quantities at one time: Newark, 2c per gal. on 200 gals. or more, less than 200 gals, 0.5c higher price; Baltimore, 2c off on 25 to 100 gals. and 3c on over 100 gals.; Washington, 2c off to contract buyers.

(N.B. Prices are Continental's "structural" prices. Prices do not reflect temporary reductions made to meet local competition.)

Notice

These prices include inspection fees on both gasoline and kerosine unless otherwise specified per gallon as follows:

Ala. 1/40c on gasoline, 1/2c on kerosine; Ark. 1/20c; Fl. 1/8c; Ill. 3/100c; Ind. 1/5c in lots of 25 bbls. or less, 2/25c in lots of more than 25 bbls.; Kans. 1/50c; La. 1/32c; Minn. 7/200c; Mis. 1/50c; Neb. 2/100c; Nev. gasoline 1/20c; N. C. 1/4c; N. Da. 1/20c; Okla. 2/25c; S. Car. 1/8c; S. Da. 1/20c; Tenn. 2/5c; and Wisc. 3/100c.

Kerosine inspection fees only: Iowa 3/50c; Mich 1/5c per gal.

CONT'L OIL

	Conoco Bronz-z-z (*Reg.*) †Tank Wagon	Demand (*3rd Grade*)	Gasoline Taxes	Kerosine T.W.
Denver, Col.	11	10	5.5	11
Grand Junc., Col.	12	11	5.5	12
Pueblo, Col.	10.5	9.5	5.5	10.5
Casper, Wyo.	11.5	10.5	5.5	12
Cheyenne, Wyo.	11	10	5.5	11.5
Billings, Mont.	12.5	11.5	6.5	12.5
Butte, Mont.	13.5	12.5	6.5	13.5
Great Falls, Mont.	12.5	11.5	6.5	12.5
Helena, Mont.	13	12	6.5	13
Salt Lake City, Utah	13.5	12.5	5.5	14.5
Boise, Ida.	14.1	13.1	6.5	16.5
Twin Falls, Ida.	15.6	14.6	6.5	17
Albuquerque, N. M.	10	9	*7	9.5
Roswell, N. M.	9.5	8.5	*7	9
Santa Fe, N. M.	10.5	9.5	*7.5	10
Ft. Smith, Ark.	9.5	9.25	*7	9.5
Texarkana, Ark.	9	8	*5.5	9
Muskogee, Okla.	9.5	8.5	7	8.5
Oklahoma City, Okla.	9.5	8.5	7	8.5
Tulsa, Okla.	9.5	8.5	7	8.5

*Taxes: In gasoline tax column are included these city taxes—Albuquerque, & Roswell, 0.5c, Santa Fe, 1c. Texas 4c state tax applies within city limits of Texarkana, Ark.; Okla. 5.5c state applies within city limits of Ft. Smith, Ark.

†To consumers & Dealers.

S. O. NEB.

(*Regular Grade*)	T.W. Dealer	Gasoline Taxes	Kerosine T.W.
Omaha	11.4	9.6	6.5	10.1
McCook	12.0	10.1	6.5	10.5
Norfolk	11 9	10.4	6.5	10.6
North Platte	12.2	10.6	6.5	11
Scottsbluff	12.9	10.2	6.5	10.5

S. O. CAL.

Standard Gasoline (*Regular Grade*)
Flight Gasoline (*Third Grade*)

	Standard Posted Net Tank Truck	Standard Posted Retail	Flight Posted Net Tank Truck	Flight Posted Retail	Gasoline Taxes
San Francisco, Cal.	10	14	9	12	4.5
Los Angeles, Cal.	9.5	13.5	8.5	11.5	4.5
Fresno, Cal	11	15	10	13	4.5
Phoenix, Ariz.	12	16	10	18	6.5
Reno, Nev.	12	16	11	14	5.5
Portland, Ore.	10.5	14.5	9.5	12.5	6.5
Seattle, Wash.	10.5	14.5	9.5	12.5	6.5
Spokane, Wash.	12.5	16.5	11.5	14.5	6.5
Tacoma, Wash.	10.5	14.5	9.5	12.5	6.5

Std. Aviation 73

	Posted Net Tank Truck	Gasoline Taxes	Kerosine Tank Truck
San Francisco, Cal.	12.5	4.5	11.5
Los Angeles, Cal.	12	4.5	10
Fresno, Cal	13.5	4.5	12.5
Phoenix, Ariz.	14.5	6.5	12.5
Reno, Nev.	14.5	5.5	13.5
Portland, Ore.	13	6.5	13.8
Seattle, Wash.	13	6.5	13.8
Spokane, Wash.	16	6.5	16.8
Tacoma, Wash.	13	6.5	13.8

Resale & Commercial: T.C. deliveries 0.25c per gal. off posted net tank truck.

Commercial: Retail deliveries, and/or tank truck deliveries of less than 40 gals., 4c per gal. above posted net tank truck price for Standard Aviation and Standard Gasoline, and 3c per gal. above posted net tank truck for Flight Gasoline, except single deliveries of less than 40 gals. to Marine trade only, which are billed at posted net tank truck price.

TEXAS CO.

	Gasoline—Dealer T.W. Fire-Chief (*Regular*)	Indian (*3rd Grade*)	Gasoline Taxes
Dallas, Tex.	7.5	6.5	5.5
Ft. Worth, Tex.	7.5	6.5	5.5
Wichita Falls, Tex.	8.5	7.5	5.5
Amarillo, Tex.	8.5	7.5	5.5
Tyler, Tex.	8.5	7.5	5.5
El Paso, Tex.	11	10.5	5.5
San Angelo, Tex.	8.5	7.5	5.5
Waco, Tex.	8.5*	7*	5.5
Austin, Tex.	8.5	7.5	5.5
Houston, Tex.	8.5	7.5	5.5
San Antonio, Tex.	8.5	7.5	5.5
Port Arthur, Tex.	8.5	7.5	5.5

*Less 1c temporary allowance to all dealers.

(Continued on next page)

Tank Wagon Prices—Continued

S. O. IND.

Red Crown (*Regular Grade*)
Blue Crown (*Third Grade*)
Red Dealer Prices

	Cons. T.W.	Red Crown	Blue Crown	Gaso-line Taxes	Kero-sine T.W.
Chicago, Ill.	11.6	9.6	9.1	4.5	10.6
Decatur, Ill.	11.6	9.6	8.7	4.5	10.3
Joliet, Ill.	11.9	10.3	9.2	4.5	10.6
Peoria, Ill.	11.7	9.9	9.7	4.5	10.4
Indianapolis, Ind.	11.6	10.1	9.6	5.5	10.1
Evansville, Ind.	11.4	9.9	8.6	5.5	9.9
South Bend, Ind.	12	10.5	10	5.5	10.5
Detroit, Mich.	11.4	9.9	9.4	4.5	10
Grand Rapids, Mich.	11.4	9.9	9.4	4.5	9.9
Saginaw, Mich.	11.4	9.9	9.4	4.5	9.9
Green Bay, Wis.	12.2	10.7	10.2	5.5	10.9
Milwaukee, Wis.	12.1	10.6	10.1	5.5	10.8
La Crosse, Wis.	11.9	10.4	9.9	5.5	10.6
Minneapolis - St. Paul	11.9	10.4	9.9	5.5	10.6
Duluth, Minn.	12.2	10.7	10.2	5.5	10.9
Mankato, Minn.	11.9	10.4	9.9	5.5	10.6
Des Moines, Ia.	11.4	9.9	9.4	4.5	*10.1
Mason City, Ia.	11.7	10.2	9.7	4.5	*10.4
St. Louis, Mo.	11.0	9.5	9.3	*4.5	10.1
Kansas City, Mo.	11.0	9.5	8.6	*4.5	9.7
St. Joseph, Mo.	11.2	9.7	9.2	*4.5	9.9
Fargo, N. D.	12.9	11.4	10.9	5.5	11.6
Huron, S. D.	12.3	10.8	10.3	5.5	11
Wichita, Kans.	10.3	8.8	7.2	4.5	9.0

Stanavo Aviation 73 Octane
Withdrawn Jan. 1, 1944.

	Oleum Spirits	V.M.&P. Naphtha	Stani-sol	*Taxes
(Prices are base prices before discounts)				
Chicago	13.5	13.8	12.8	4.5
Detroit	15.8	15	16.3	4.5
K. C., Mo.	13.3	14.3	13.8	1.5
St. Louis, Mo.	13.7	14.7	13.2	1.5
Milwaukee	14.4	15.4	14.9	5.5
Minneap'ls	14.2	15.2	13.5	5.5

Fuel Oils T.W.
Chicago

	Standard Heater Oil
1-99 gals.	9.3
100-149 gals.	8.3
150 gals. & over	7.8

	Stanolex Furnace Oil
1-99 gals.	8.8
100-149 gals.	7.8
150-399 gals.	7.8
400 gals. & over	7.3

	Stanolex Fuel Oil A
1-99 gals.	8.3
100-399 gals.	7.3
400-749 gals.	6.3
750 gals. & over	5.55

	Stanolex Bunker C Fuel Oil
1-399 gals.	6.8
400-999 gals.	5.8
1000 gals. & over	4.8

Other Points	Stanolex Furnace Oil
Indianapolis	
1-99 gals.	9.0
100 gals. & over	8.0
Detroit	
1-99 gals.	8.7
100 gals. & over	7.7
Milwaukee	
1-99 gals.	9.0
100 gals. & over	8.0
Minneapolis	
1-99 gals.	9.1
100 gals. & over	8.1
St. Louis	
1-99 gals.	8.4
100 gals. & over	7.4
Kansas City	
1-99 gals.	8.1
100 gals. & over	7.1

*Taxes: In gasoline tax column are included these city taxes—Kansas City, St. Joseph and St. Louis, 1c. Iowa kerosine prices are ex 3c state tax. In naphtha tax column are included 1.5c federal tax and state taxes.

State sales, occupation, consumer and use taxes to be added when applicable.

HUMBLE OIL

Humble Motor Fuel (*Regular Grade*)
Thriftane (*Third Grade*)

	Humble *Tank Wagon	Humble Re-tail	Thriftane *Tank Wagon	Thriftane Re-tail	Gaso-line Taxes
Dallas, Tex.	7.5	10.5	6.5	10.5	5.5
Ft. Worth, Tex.	6.5	9.5	6	7.5	5.5
Houston, Tex.	8.5	12.5	7.5	10.5	5.5
San Ant., Tex.	8.5	12.5	7.5	10.5	5.5

	Kerosine *Tank Wagon	Kerosine Retail
Dallas, Tex.	7	10
Ft. Worth, Tex.	7	11
Houston, Tex.	8	11
San Antonio, Tex.	7	10

73 Oct. Aviation Gasoline	Tank Car
FOB Baytown, Tex.	8.5

*To all classes of dealers & consumers.

Fuel oils—Statewide prices are for t.w. & drum deliveries of 50 gals. or more; prices for deliveries of less than 50 gals. are 0.5c higher. Cleveland Division assumed the state-wide fuel oil tank wagon prices on Nos. 1, 2 and 3 fuel oil, effective May 10. However the price of 7.55c per gallon and No. 4 fuel oil (full compartment hose dumps only) will remain as heretofore, in Cleveland Division.

Naphthas—to contract consumers off t.w. prices—Statewide: 300 to 999 gals., 0.5c; 1000 to 2499 gals., 0.75c; 2500 to 4999 gals., 1c; 5000 or more gals., 1.5c. Lucas County: Less than 50 gals., tank wagon price. 50 to 249 gals., 0.5c; 250 to 499 gals., 1c; 500 gals. or over, 1.5c.

S. O. OHIO

*Sohio X-70 Gasoline (*Regular Grade*)

	Con-sumer T.W.	**Re-sel-lers	Gaso-line Taxes	†Kero-sine ‡S.S. T.W.
Ohio, Statewide	12	10	13.5	5.5	9.3
Akron	12	9.5	12.5	5.5	9.3
Cincinnati	12	9.5	12.5	5.5	9.3
Cleveland	12	9.5	12.5	5.5	9.3
Columbus	12	9.5	12.5	5.5	9.3
Dayton	12	9.5	12.5	5.5	9.3
Marietta	12	9.5	12.5	5.5	9.3
Portsmouth	12	9.5	12.5	5.5	9.3
Toledo	12	9.5	12.5	5.5	9.3
Youngstown	12	9.5	12.5	5.5	9.3

Aviation Gasoline—Statewide

	Consumer T.W.	Gasoline Taxes
Sohio Aviation Gasoline clear Spec. AN-F-22	14.5	5.5
Esso Ethyl Aviation 73 Oct.	15.5	5.5
Esso Ethyl Aviation 80 Oct.	16.5	5.5
Esso Ethyl Aviation 87 Oct.	17.5	5.5
Esso Ethyl Aviation 91 Oct.	17.5	5.5
Esso Ethyl Aviation 100 Oct.	25.5	5.5

	†Naphtha—T.W. Statewide	Lucas County
S. R. Solvent	13.5	13.5
D. C. Naphtha	14.5	14.25
V.M.&P. Naphtha	14.5	14.25
Varnolene	14.5	14.25
Sohio Solvent	14.5	14.25

Fuel Oil—T.W.	No. 1	No. 2	No. 3	No. 4
Ohio, Statewide	8.3	8.3	7.8	7.55*

*Renown (third-grade) prices are same as X-70 unless otherwise noted.

**Except authorized agents.

†Kerosine prices are ex 1c state tax. Naphtha prices are ex 1.5c federal & 4c state tax.

‡Prices at company-operated stations.

††Statewide prices are subject to exceptions other than those shown.

Discounts:

Esso aviation—on contract to hangar operators and resellers, 2c off consumer t.w.

*For Cleveland area only.

Canada

PRICES OF IMPERIAL OIL, LTD.

Per Imperial Gallon, which is 1.2 U. S. Gallons

IMPERIAL OIL

3-Star Imperial Gasoline (*Regular Grade*)

	†Gasoline T.W.	*Gasoline Taxes	†Kero-sine T.W.
Hamilton, Ont.	17.5	11	18
Toronto, Ont.	17.5	11	18
Brandon, Man.	21	10	23
Winnipeg, Man.	20.5	10	22.5
Regina, Sask.	18	10	20
Saskatoon, Sask.	20.8	10	22.8
Edmonton, Alta.	18.9	10	20.9
Calgary, Alta.	16	10	18
Vancouver, B. C.	15	10	24
Montreal, Que.	17	11	17.5
St. John, N. B.	16.5	13	19
Halifax, N. S.	16.5	13	19

*Includes 3c Federal, and Provincial taxes. To divided & undivided dealers.

ATLANTIC REFINING

Atlantic White Flash (*Regular Grade*)

	Commercial T.W.	Dealer T.W.	Gaso-line Taxes	Kero-sine T.W.
Philadelphia, Pa.	10.2	10.7	5.5	12.25
Pittsburgh	10.7	11.2	5.5	12.6
Allentown	10.7	11.2	5.5	12.6
Erie	10.7	11.2	5.5	12.6
Scranton	10.7	11.2	5.5	12.6
Altoona	10.7	11.2	5.5	12.6
Emporium	10.7	11.2	5.5	12.6
Indiana	10.7	11.2	5.5	12.6
Uniontown	10.7	11.2	5.5	12.6
Harrisburg	10.7	11.2	5.5	12.6
Williamsport	10.7	11.2	5.5	12.6
Dover, Del.	....	11.2	5 5	12.6
Wilmington, Del.	....	10.7	5.5	12.1
Boston, Mass.	....	10.9	5.5	....
Springfield, Mass.	....	11.8	4.5	....
Worcester, Mass.	....	11.5	4.5	....
Fall River, Mass.	....	11	4.5	....
Hartford, Conn.	....	11.6	4.5	....
New Haven, Conn.	....	11	4.5	....
Providence, R. I.	....	11	4.5	....
Atlantic City, N. J	....	10.7	4.5	10
Camden, N. J.	....	10.7	4.5	10
Trenton, N. J.	....	10.7	4.5	10
Annapolis, Md.	....	11.05	5.5	10.8
Baltimore, Md.	....	10.45	5.5	9.8
Hagerstown, Md.	....	11.55	5.5	10.3
Richmond, Va.	....	11.25	6.5	12.3
Wilmington, N. C.	....	11.55	7.5	11.9
Brunswick, Ga.	....	10.4	7.5	11.1
Jacksonville, Fla.	....	10.4	8.5	12.1

	Mineral Spirits T.W.†	V.M.&P. T.W.†
Philadelphia, Pa.	11	12.5
Lancaster, Pa.	12	13.5
Pittsburgh, Pa.	12.5	13.5

Fuel Oils—T.W.

	1	2	3	5	6
Phila., Pa.	10.1	9	9	5.76	5.04*
Allentown, Pa.	10 6	9.3	9.3	....	....
Wilmington, Del.	10.1	9	9	....	....
Springfield, Mass.	10.2	9.4	9.4	....	....
Worcester, Mass.	10.2	9.3	9.3	....	....
Hartford, Conn.	10.5	9	9	....	....

‡Does not include 1c Georgia kerosine tax.

†Mineral Spirits prices also apply to Stoddard Solvent; V.M.&P. prices also apply to Light Cleaners Naphtha.

Discounts:

Gasoline—to undivided dealers, 0.5c off dealer t.w., except Georgia & Florida dealer t.w. and undivided dealer t.w. prices are same.

Kerosine—Thru Penna. & Delaware, 2c off t.w. price on t.w. deliveries of 25 gals. or more at one time.

*Residual fuel 13.0-15.9 gravity effective 10/17/43.

S. O. KY.

Crown Gasoline (*Regular*)
Standard (*Third Grade*)

	†Net Crown	Dealer Standard	Gaso-line Taxes	Kero-sine T.W.
Covington, Ky.	9.5	...	6.5	9.3
Lexington, Ky.	10.5	...	6.5	9.3
Louisville, Ky.	10	...	6.5	8.8
Paducah, Ky.	10	...	6.5	8.8
Jackson, Miss.	10	...	7.5	*9
Vicksburg, Miss.	9.5	...	7.5	*8.5
Birmingham, Ala.	10	...	*8.5	9
Mobile, Ala.	9	...	*9.5	9.5
Montgomery, Ala.	10	...	*9.5	10
Atlanta, Ga.	11.4	...	7.5	*12.1
Augusta, Ga.	11.4	...	7.5	*11.6
Macon, Ga.	11.4	...	7.5	12.1
Savannah, Ga.	10.4	...	7.5	11.1
Jacksonville, Fla.	10.4	...	8.5	10.1
Miami, Fla.	10.4	...	8.5	10.1
Pensacola, Fla.	9	8	*9.5	8
Tampa, Fla.	10.4	...	8.5	10.1

*Taxes: In tax column are included these city and county gasoline taxes: Mobile, 2c city; Birmingham, 1c city; Montgomery, 1c city and 1c county; Pensacola, 1c city. Georgia and Montgomery, Ala. have 1c kerosine tax, Mississippi 0.5c, not included in above prices.

†Consumer t.w. prices are same as net dealer prices.

S. O. LA.

Esso Gasoline (*Regular Grade*)

	Consumer Tank Wagon	Dealer T.W.	Gaso-line Taxes	Kero-sine T.W.
New Orleans, La.	8.75	9.25	8.5	*9
Baton Rouge, La.	8.75	9.25	8.5	*9.5
Alexandria, La.	8.75	9.25	8.5	*9.5
Lafayette, La.	9	9 5	8.5	*9
Lake Charles, La.	9	9.5	8.5	*11
Shreveport, La.	8.5	9	8.5	*8
Knoxville, Tenn.	10.5	11	8.5	12.5
Memphis, Tenn.	8.90	9.40	8.5	10.5
Chattanooga, Tenn.	10.5	11	8.5	11
Nashville, Tenn.	10.5	11	8.5	10
Bristol, Tenn.	10.95	11.45	8.5	13.1
Little, Rock, Ark.	9.5	10	8	10

*Louisiana kerosine prices are ex 1c state tax.

Discounts:

Esso Gasoline—To undivided dealers, 0.5c off dealer t.w.

(Continued on next page)

Atlantic Coast (Prices are of refiners, FOB their refineries & their tanker terminals, & of tanker terminal operators FOB their terminals)—Prices in Effect Jan. 31

MOTOR GASOLINE

District:	72 Oct. (ASTM)	68-70 Oct. (ASTM)
N. Y. Harb.	9.2 – 9.4	9.2 (1)
N. Y. Harb., barges	9.1 – 9.3	9.1 (1)
Albany	9.3 – 9.5	....
Philadelphia	9.2	....
Baltimore	8.95	8.85 (1)
Norfolk	8.7 – 8.95	8.5 (1)
Wilmington, N. C.	8.7 – 8.75	8.5 (1)
Charleston	8.7 – 8.8	8.1 (1)
Savannah	8.25 – 8.4	....
Jacksonville	8.27 – 8.4	....
Miami	8.27 (1)	....
Tampa	8.27 – 8.2	8.275 (1)
Pensacola	7 – 7.2 (1)	....
Mobile	7 – 7.2	....
New Orleans	6.125– 6.75	....
Portland	9.5 – 9.65	....
Boston	9.4 – 9.7	9.7 (1)
Providence	9.4 – 9.7	....

FUEL OILS

	KEROSINE and /or NO. 1 FUEL	No. 2	No. 3	No. 5	No. 6
N. Y. Harb.	7.1	6.7	6.7	$1.95–$2.01 (a)	$1.65 –$2.07
N. Y. Harb., barges	7	6.6	6.6	....	....
Albany	7.3	6.8	6.8 (2)	....	$1.85–$2.27 (1)
Philadelphia	7.2	6.7	6.7	$1.98	$1.65 –$2.07
Baltimore	7.2	6.7	6.7	....	$1.65 –$2.07
Norfolk	7.1	6.7	6.7 (1)	....	$1.65–$2.07 (2)
Wilmington, N. C.	7.05	6.7	....	....	....
Charleston	7.2	6.7 (2)	....	....	$1.60–$2.02 (2)
Savannah	7.05	....	....	....	$1.60–$2.02 (1)
Jacksonville	7.05 (2)	6.25	....	....	$1.60–$2.02 (1)
Miami	7.05 (2)	....	....	....	....
Tampa	7.05	6.25 (2)	....	....	$1.50–$1.92 (2)
Pensacola	4.8 (1)	....	....	....	....
Mobile	4.75 (2)	....	....	....	....
New Orleans	4.25 – 4.75	3.75 (2)	....	$1.27 (1)	$0.85–$1.27 (2)
Portland	7.3	6.8	6.8 (2)	....	$1.65–$2.07 (1)
Boston	7.2	6.7	6.7 (2)	$1.95–$2.07 (1)	$1.65 –$2.07
Providence	7.2	6.7	6.7 (2)	$1.90 (1)	$1.65 –$2.07

(a) This price is for a straight-run low pour test No. 5 fuel.

Pacific Export *In Ship's Bunkers, or deep tank lots:*

Prices in Effect	Jan. 31	Jan. 24
Diesel Fuel, Pac. Spec. 200	$1.40 –$1.45	$1.40 –$1.45
Grade C fuel, Pac. Spec. 400	$1.10	$1.10

Seaboard Export Coastwise Prices

Tank Wagon Prices (Continued)

SOCONY VACUUM

	Socony (Regular Grade) Com. Cons. T.W.	Mobilgas Indiv. Dlr. T.W.	Gasoline Taxes
New York City			
Manhattan & Bronx	10.1	10.6	*5.5
Kings & Queens	10.1	10.6	*5.5
Richmond	9.7	10.2	*5.5
Albany, N. Y.	9.9	10.4	5.5
Binghamton, N. Y.	11	11.5	5.5
Buffalo	10.2	10.7	5.5
Jamestown, N. Y.	10.4	10.9	5.5
Mt. Vernon, N. Y.	10.1	10.6	5.5
Plattsburg, N. Y.	11	11.5	5.5
Rochester, N. Y.	10.8	11.3	5.5
Syracuse, N. Y.	10.5	11	4.5
Bridgeport, Conn.	10	10.5	4.5
Danbury, Conn.	10.5	11	4.5
Hartford, Conn.	10.6	11.1	4.5
New Haven, Conn.	10	10.5	4.5
Bangor, Me.	10.7	11.2	5.5
Portland, Me.	10.3	10.8	5.5
Boston, Mass.	9.9	10.4	4.5
Concord, N. H.	11.4	11.9	5.5
Lancaster, N. H.	12	12.5	5.5
Manchester, N. H.	11.3	11.8	5.5
Providence, R. I.	10	10.5	4.5
Burlington, Vt.	10.9	11.4	5.5
Rutland, Vt.	11	11.5	5.5

	Mineral Spirits T.W.	V.M.&P. T.W.
Buffalo, N. Y.	12.4	13.6
New York City	11	12
Rochester, N. Y.	13.2	14.4
Syracuse, N. Y.	14	....
Boston, Mass.	12	13
Bridgeport, Conn.	†16.3	†17.3
Hartford, Conn.	†16.3	†17.3
Providence, R. I.	13	14

	Kerosine Yard	Kerosine T.W.	Mobilfuel Diesel T.C.	Mobilfuel Diesel T.W.	Mobilheat Fuel Yard	Mobilheat Fuel T.W.
New York:						
Manhat'n & Bronx	7.5	10.3	...	9.3	7.1	9
Kings & Queens	7.5	10.3	...	9.3	7.1	9
Richmond	7.5	10.3	...	...	7.1	9.0
Albany	7.5	9.8	7	9.3	7	9
Binghamton	8.9	11.2	...	10.7	8.4	10.2
Buffalo	8.6	10.9	8	10.3	8.2	10
Jamestown	8.7	11	...	10.6	8.3	10
Mt. Vernon	7.6	10.3	...	9.4	7.2	9
Plattsburg	8.1	10.4	...	9.9	7.6	9.4
Rochester	8.7	11	7.9	10.2	7.9	9.7
Syracuse	8.5	10.8	7.8	10.1	7.8	9.6
Conn.:						
Bridgeport	7.8	10.3	...	....	7.2	8.8
Danbury	8.2	10.8	...	....	7.5	8.8
Hartford	8 0	10.5	...	9.5	7.2	9
New Haven	7.8	10.3	...	9.3	7	8.9
Maine:						
Bangor	7.9	10.2	7.4	9.7	7.4	9.1
Portland	7.5	10.2	7	9.3	7	9
Mass.:						
Boston	7.8	10.6	6.9	9.2	7.1	9
N. H.:						
Concord	8.4	10.7	...	....	8.2	10
Lancaster	9.5	11.8	...	....	9.2	11
Manchester	8.5	11.1	...	....	7.9	9.7
R. I.:						
Providence	7.6	9.9	6.9	9.2	7.1	8.9
Vermont:						
Burlington	8.1	10.4	7.5	9.8	7.5	9.2
Rutland	8.3	10.6	...	10	7.7	9.5

*Does not include 1% city sales tax applicable to price of gasoline (ex tax).
†In steel barrels.
Discounts: Diesel—On t.w. deliveries, 0.5c for at least 400 gals.; 1c for full tank truck.

	Bunker C Fuel Ships' bunkers (Ex Lighterage)	Diesel Oil Ships' bunkers (Ex Lighterage)	Diesel Oil Shore Plants	Gas House Gas Oil 28-34 Gravity
N. Y. Harbor	$1.65–$2.07	$2.78	6.7–6.8 (2)	6.8 (2)
Albany	$1.85 (1)	$2.98 (1)	7 (1)	6.7
Philadelphia	$1.65–$2.07	$2.78	....	....
Baltimore	$1.65–$1.89	$2.78	6.7 (1)	6.7 (1)
Norfolk	$1.65–$2.07	$2.78	6.7 (1)	6.7 (1)
Charleston	$1.60–$2.02	$2.78 (2)	6.7 (1)	6.7 (1)
Savannah	$1.65–$1.89	$2.62 (1)	....	....
Jacksonville	$1.60–$2.02 (2)	$2.62 (2)	....	....
Tampa	$1.50–$1.92	$2.62 (2)	....	....
New Orleans	$0.97–$1.09	$1.65 (1)	4 (1)	....
Portland	$1.65–$1.89	$2.86 (2)	7 (1)	6.9 (1)
Boston	$1.65–$1.89	$2.78	6.7 (2)	6.8 (2)
Providence	$1.65–$2.07	$2.78 (2)	6.9 (1)	6.8 (1)

Residual fuel prices generally vary with A.P.I. specifications from range low for 9.9 & below degrees to range high for 25.0 & above.

Gulf Coast

Prices in Effect Jan. 31

MOTOR GASOLINE	New Orleans & Lower Mississippi to Baton Rouge Tank Cars	New Orleans & Lower Mississippi to Baton Rouge Barge	Texas Gulf Coast South of New Orleans Tank Cars	Texas Gulf Coast South of New Orleans Barges	CARGOES Domestic & Export From all Gulf Ports
Leaded (oct by ASTM)					
76 oct.	6.75	6.5 – 6.75	6.75	6.75	6.75
72 oct.	6.125	5.75	5.75	5.75	5.75
63-65 oct.	....	....	....	....	....
Unleaded 70 oct.	....	....	....	....	5.75
67-68 oct.	....	....	....	....	5.5
65 oct.	....	....	....	....	5.25
60 oct.	....	....	....	....	5
KEROSINE & LIGHT FUELS					
41-43 w.w. kero.	4.125–4.25	4.125	4.125–4.25	4.125	4.125
42-44 w.w. kero.	....	....	4.125	4.125	4.125
No. 2 fuel oil.	3.75	3.75	3.75 – 4	3.75	3.75
DIESEL & GAS OILS					
(In diesel index No.)					
Below 43 di.	....	....	....	....	....
43-47 di.	....	....	....	....	4
48-52 di.	4	4	4	4	4
53-57 di.	4.125	4.125	4.125	4.125	4.125
58 and above	4.25	4.25	4.25	....	4.25

HEAVY FUELS & BUNKER OILS In Cargoes (At all Gulf Ports) Heavy Diesels	In Ship's Bunkers (Ex lighterage)
Below 28 API Grav.	$1.35
28 & above API Grav.	$1.65
Bunker C Oil	$0.85–$1.27

Above products in Truck Transports of 2,400 gal. and over ½c above Tank Car Prices.

NOTE—Prices for heavy fuels vary within the range given above according to gravity from 9.9 B grav. and below to 25 B and above.

Mid-Continent Lubes

(At Gulf; in packages, FAS.; in bulk, FOB terminals)

Prices in Effect Jan. 31

	Steel Drums	Bulk
200 Vis. D 210 brt. stock	35 (1)	28.8 (1)
150 vis. D 210 brt. stock 0-10 p.p.	31 (1)	24.8 (1)
10-25 p.p.	....	....
100 vis. D 210 brt. stock 0-10 p.p.	....	....
10-25 p.p.	....	....
200 vis. No. 3 col. neutral: 0-10 p.p.	....	....

Wax

(Melting points are AMP, 3° higher than EMP. Prices are FOB refinery and do not include bag, freight or export differentials).

Prices in Effect Jan. 31

Crude Scale	New Orleans Export	N. Y. Domestic	N. Y. Export
124-6 Yellow	4.25(1)	....	4.25(1)
122-4 White.	....	4.25(2)	4.25(2)
124-6 White.	4.25(1)	4.25	4.25
Fully Refined:			
123-5	5.2(1)	5.2(2)	5.2(1)
125-7	5.2(1)	5.2(2)	5.2(1)
128-30	5.6(1)	5.6	5.6(1)
130-32	5.85(1)	5.85(2)	5.85(1)
133-5	6.15(1)	6.15	6.15(1)
135-7	6.4(1)	6.4(1)	6.4(1)

Naphtha

Prices In Effect Jan. 31

	V.M.&P. Naphtha	Mineral Spirits
New York Harbor	11 (2)	10
Philadelphia dist.	11 (2)	10
Baltimore	10.5 (2)	9.5
Boston	11.5 (2)	10.5
Providence	11.5 (1)	10.5 (2)

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If You Can't Use It, Sell It or Scrap It!

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One Dodge Oil Truck: capacity 860 gallons; 3 compartments; Ticket Printer Neptune Auto-Stop Meter 1½-inch.

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GMC trailer and Quaker City tank.

Lancaster Motor Truck Service
459 Juliette Ave., Lancaster, Penna.

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Wholesale and Retail, Gasoline and Fuel Oil Franchise for sale. Did $125,000.00 of business last year; all cash business. Have a large station fully equipped. 3100 gallon transport Diamond T. tractor with a new motor and extra good tires. 1½ Ton Chevrolet; ¾ Ton Chevrolet both 1941 trucks with tanks; 55,000 gallon storage all equipped with pumps and meters.

For price and terms write.

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Skidmore, Missouri

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POLY PLANT OPERATORS

For new Aviation Gasoline Refinery consisting of Catalytic Cracking, Alkylation, and Isomerization Units. Location, Middlewest. In reply, give detailed outline of previous experience, education, draft status, and required earning for 48-hour week.

Reply Box No. 331

• • • • WANTED • • • •

Major oil company with continent-wide operations and research seeks graduate technical men of the following qualifications:

MECHANICAL ENGINEERS—with petroleum refinery or similar experience. Should be familiar with refinery design, estimating, construction, mechanical equipment, engineering materials, and utilities systems. Process knowledge desired although not essential.

CHEMISTS AND CHEMICAL ENGINEERS interested in research, design, or plant operation. Should have training and experience in refinery or other industrial organizations.

Work not of a temporary nature. In reply state experience, education, age, marital status, draft classification and salary expected, include small snapshot (not returnable). Replies strictly confidential. Applicants now employed at highest skill in war industries not solicited.

National Petroleum News, Cleveland, Ohio.

• • • • • • • • • • • • • • •

Wanted to Buy

WANTED TO BUY: Grease kettles pressure and mixing. State type, capacity, condition and where located. Box No. 311.

WANTED TO BUY: Transport Trailer and Truck, late model, 2500 gallon to 3000 gallon, multiple compartments. Advise price and all other information. L. L. Hood, P. O. Box 704, Homestead, Fla.

WANTED TO BUY

900 to 1200—three (3) or more compartment straight tank truck—1½ to 2½ ton capacity.

Phone 200 St. Marys, West Virginia, Mr. Skaggs.

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ABOUT OIL PEOPLE

T. F. Thompson, president of Worth Refining Co., Blue Island, Ill., is vacationing in Florida. Also Florida-bound is **Alfred J. Hedlund,** of the W. H. Barber Co., who will travel to Miami to spend a month with his seven-month-old grand-daughter, and her parents.

* * *

Ralph D. Chamber has been added to the geology staff of the Richfield Oil Corp. at Midland, Texas. He was formerly with the U. S. Army Engineers at Little Rock, Ark. He is a graduate of the University of Colorado.

* * *

Robert I. Dickey has been elected president of the West Texas Geological Society. He is associated with the Forest Development Corp. Other officers are **George R. Gibson,** Richfield, vice-president; and **Miss Jane Ferrell,** Magnolia Petroleum, secretary-treasurer.

* * *

Capt. Martin Olsen, tanker master who has sailed tankers in two world wars and who has completed 30 years with the Esso tanker fleet, was honored Jan. 18 at luncheon by 70 associates in the marine department of the Standard Oil Co. of New Jersey. He was presented with a watch by **B. B. Howard,** marine department manager. (See photo below.)

The veteran skipper who never has been torpedoed, although he has sailed through thousands of miles of submarine-infested waters, began his marine career at 14 on a Norwegian square-rigger. His oil fleet job was aboard a barge in New York in 1900. Later he shipped aboard Great Lakes and coastwise tankers, serving as cook, pumpman, bosun, second mate and chief mate.

When World War I broke out, he went to sea on British ships, but returned to the tanker service in 1918, joining the Esso fleet aboard the O. B. Jennings as chief officer. He was aboard her when she collided off the Isle of Wight with a British cargo ship. Fifty-seven of the cargo ship crew were lost and one of the tanker crew. He received his first Esso command in 1923. He is the only deepwater skipper now active in the Esso fleet who has had 30 years service.

Joseph Jensen, chief petroleum engineer for Tide Water Associated Oil Co., has been renominated as a director of the Los Angeles Chamber of Commerce.

* * *

John L. Anderson of Electra, Tex., district superintendent of production for Magnolia Petroleum there, has been shifted to Pampa for the same job in the Panhandle district. His post in Electra will be filled by **O. S. Hodges** of Lovington, N. M.

* * *

Marshall S. Pease, manager of the tire, battery and accessory department of Tide Water Associated Oil Co., was elected Pacific Coast chairman of the Oil Industry Tire, Battery and Accessory Executives at the organization's recent post-war planning clinic.

* * *

Election of **George A. Davidson** to the assistant vice-presidency of Standard Oil Co. of California, has been announced by **H. D. Collier,** company president. Mr. Davidson has been with California Standard for the past 23 years, coming to the organization following his graduation from the University of California in 1920.

* * *

New vice-president in charge of refining for Cosden Petroleum Corp. is **J. Blount Mull,** manager of refining since April, 1942. Mr. Mull joined Cosden as refinery technologist and assistant to the president in September, 1940. Previously he was for 14 years with the Shell Oil Co.

* * *

Ora A. Davisson, since 1932 foreman of the salvage and reclamation department of Standard Oil Co. of Louisiana, retired from service Jan. 1 after 34 years in the oil business. During that time Mr. Davisson had not lost a single day of work due to illness. He started with Ohio Oil Co. in Indiana in 1909. Two years later he was sent to Shreveport where he worked as a field machinist with the Standard Oil Co. of Louisiana's producing department. He has been with the company ever since. **J. A. Williams,** formerly of Louisiana Standard's inspection division, has been named to succeed Mr. Davisson.

* * *

New officers of the West Texas Oil Scouts Assn. with headquarters in Midland, Tex., are: **C. L. Cornelius,** Gulf Corp., president; **Joe G. Sauer,** Cities Service Oil Co., first vice-president; **Arvid A. Jones,** Atlantic Refining Co., second vice-president, and **Orville L. McNew,** Amerada Petroleum Corporation, secretary-treasurer. All are from Midland except Sauer, who is from Odessa.

Ray E. Miller, vice president of Hanlon-Buchanan, Inc., was elected president of the Tulsa Area Council of Boy Scouts at a recent meeting of the executive board and members at large. Vice presidents elected include **W. L. Connelly,** chairman of the board of Sinclair Prairie Oil Co., and **Frank A. Stivers,** vice president of Texas Empire Pipe Line Co. **C. E. Buchner,** executive manager of the Independent Petroleum Assn. of America, and **Barton P. Sibole,** president of Stanolind Oil & Gas Co., were chosen national council representatives.

* * *

John A. McCutchin, chief engineer for the British American Oil Co. at Tulsa, resigned Jan. 1, to become associated with his brother in drilling and general oil producing with offices at Dallas. Mr. McCutchin has been doing special work in Canada for British American Oil Co., Ltd.

* * *

Executive Committee director for the Foreign Trade Assn. of San Francisco is **J. J. Lermen, Jr.,** Tide Water Associated Oil Co.'s export manager. Elected at a recent meeting, Mr. Lermen will hold the post throughout 1944.

* * *

L. A. Odom, president of War Emergency Co-Operative Assn., has resumed his duties following a recent serious illness which sent him to a Spartanburg, S. C. hospital.

* * *

Roy L. Brecke, executive secretary to Gov. Goodland, has announced his resignation as executive secretary of the Wisconsin Petroleum Assn., state oil jobbers association.

* * *

John Steiger, Bartlesville, of the Cities Service public relations department and editor of *The Empire,* became the proud father of a girl for the third time with the advent of Judith Kay, born Jan. 19. He describes the newcomer at birth as weighing 7½ lbs. "and not bald like pappy". Incidentally, daughter Janet was born on the same date four years ago. John formerly was in charge of NPN's Tulsa office.

* * *

E. F. (Ted) Caldwell, for 11 years secretary of the Burning Oil Distributors Assn. in Chicago, also became secretary of the distribution division, Oil Heat Institute of America, on Jan. 1. He will assume new duties shortly when the office of distribution division of O. H. I. is moved from New York to Chicago for the greater convenience of General Chairman **Frank E. Spencer,** who is also president of B. O. D. A.

Marlin E. Sandlin of Houston, has resigned his partnership with the law firm of Fountain, Cox and Sandlin, effective Jan. 1, to become associate general counsel and secretary for the Woodley Petroleum Co. The Woodley company is headed by **Maj. J. R. Parten,** former PAW director of transportation.

° ° °

Frank Phillips, chairman of the board of Phillips Petroleum Co., has been elected a member of the board of the Missouri-Kansas-Texas Railroad Co.

James A. Hogshire, Jr., formerly president of the Wake Up System, Inc., Indianapolis, has been made a lieutenant colonel. He is stationed in England with the 9th Air Service Command. Before being transferred to England, Col. Hogshire was in charge of the 9th Air Force's gasoline and oil supply in the Cairo area. Before he went into business for himself, Lt. Col. Hogshire was employed by the Mid-Continent Co., in St. Louis, and The Texas Co., in Lafayette, Ind.

° ° °

Maj. Jerry Sadler, snuff-dipping former Texas Railroad commissioner, has arrived safely overseas, a cable received by his wife in Austin announced. Maj. Sadler had been home on leave. He had been stationed in Iran.

° ° °

Lieut. Weldon T. Weekley, former editor of the Humble Club *Bulletin* and member of the advertising department of Humble Oil & Refining Co., has completed his training at Biloxi, Miss., and reported to the New Orleans Naval Armed Guard Center to await assignment as commander of a Navy gun crew aboard an American merchant vessel.

° ° °

Lieut. E. T. Ullstrom, former senior petroleum engineer in the production department of Carter Oil Co., has been assigned to Camp Peary, Va., after several months of foreign service with the Seabees.

° ° °

Buck Bratcher, Centralia, Wash., Seattle division of Shell Oil Co., is now in the army, studying the Japanese language at the University of Chicago.

° ° °

First man to enter the service from the Okmulgee refinery of Phillips Petroleum Co. was **Louis S. Feighny,** who is now a major in the air corps.

Legal meat, without red ration stamps, is the enviable position of several Arizona division Shell Oil Co. men. **H. Harold Davis,** industrial area supervisor, hit the jackpot recently in the Nimrod league, returning from various hunting trips with an antelope, deer, elk, and turkey. **Perry D. Bradley,** industrial supervisor, got his first deer, while **R. L. Tate,** Yuma agent, during the elk season filled his ice box with elk meat. **Milo F. Gardner,** Phoenix, went after wild fowl, and got his limit of duck and quail at Salt River.

° ° °

Five Bucks. Not the folding kind, but the eating variety, is the haul of Skelly Oil Men **Al Kaufman, Donald Hooper, Frank Wills, George Elwood** and **Harold Clark,** all of Calhan, Colo., who recently returned from a very successful three-day hunt. In addition to the five bucks, there were four doe, the larger two bucks weighing over 300 pounds each.

° ° °

Lacking luck, but long on ingenuity, the *Sohian* reports that oil man **H. M. Roberts,** Zanesville, Ohio, unable to live up to a promise to bring a friend a couple of rabbits raided the ice box of another friend who was more lucky. The result was Mr. Roberts retains his reputation as a bring-em-back hunter.

° ° °

Local manager **Ambrose J. Martin,** Shell Oil Co., Carson City, Nev., has been appointed by the Lion's Club to a committee which will plan rehabilitation of returning veterans.

° ° °

Retirement of **Logan W. Marshall,** tax attorney and manager of the general tax department of The Pure Oil Co., Chicago, effective Feb. 1, has been announced by the company. Mr. Marshall will continue his company association as a tax consultant and counselor on general tax matters as long as his health permits. His retirement after many years of active service, was on the advice of his physician. W. B. Keeley, assistant secretary and assistant treasurer and Guy W. Chase, assistant manager, will have future direction of the general tax department, the announcement said.

° ° °

Among the newly appointed directors of the Tulsa Chamber of Commerce are **B. W. Vinson,** president of Vinson Supply Co., and **Paul Griffin,** president of Oklahoma Pipe Line Co. They were chosen by the Chamber's new president, **Phil H. Bohart,** assistant to the vice president of Gulf Oil Corp., and will serve for a year.

° ° °

Gay Carroll, comptroller for Humble Oil & Refining Co., has been chosen for membership in the Comptrollers Institute of America's Committee on Education.

LAZYBENCH

Sonia Milan, an "oil-gal" from Bayonne, N. J. rates the Lazybench this week with this contribution. To Miss Milan goes a box of NPN chocolates for the following copy of a letter, in reply to a request for a check, which came to her attention:

Philadelphia, Pa.

"My dear Sirs:

"In reply to your request to send a check, I wish to inform you that the present condition of my bank account makes it almost impossible. My shattered financial condition is due to Federal laws, State laws, County laws, City laws, Corporation laws, Liquor laws, Mother-in-laws, brother-in-laws, sister-in-laws, and outlaws.

"Through these laws I am compelled to pay a business tax, amusement tax, head tax, school tax, gas tax, light tax, water tax, sales tax, liquor tax, income tax, food tax, furniture tax and excise tax. I am required to get a business license, car license, truck license, not to mention a marriage license and dog license.

"I am also required to contribute to every society and organization which the genius of men is capable of bringing to life; to women's relief, war relief, the unemployed relief and the gold digger's relief. Also to every hospital and charitable institution in the City, including the Salvation Army, Community Chest, Red Cross, Purple Cross, Boy Scouts, Girl Scouts, Y.M.C.A., Y.W.C.A. and U.S.O. . . .

"My business is so governed that it is no easy matter to find out who owns it. I am inspected, expected, suspected, disrespected, rejected, dejected, examined, re-examined, informed, required, summoned, fined, commanded and compelled, until I provide an inexhaustible supply of money for every known need, desire or hope of the human race.

"Simply because I refuse to donate to something or other, I am boycotted, talked about, held up, held down and robbed, until I am almost ruined.

"I can tell you honestly that except for a miracle that happened, I could not enclose this check. The wolf that comes to many doors now-a-days just had pups in my kitchen. I sold them and here is the money."

° ° °

From the "Trinity Tidings," official publication of the Trinity Episcopal Church, Tulsa, Oklahoma:

"There are some basic facts about the Bible that all of us ought to know . . . for instance, if we want to remember how many books there are in the Bible, think of 'Phillips 66.' (We must be careful, however, about advertising oil companies lest we meet the same experience as the Methodist preacher in Texas who prayed that the Lord would bless the pure and the humble—and someone interrupted him and said, 'Don't forget the Gulf and Magnolia!') . . ."

Never in the field of human conflict was so much owed by so many to so few.

— Winston Churchill's tribute to the British Air Pilots, August 20, 1940.

Saluting the Operating Men of Petroleum Transport!

Yes, we, too, salute the airmen of Britain, the United States and of all the other Allied nations. They have done, and are doing, a magnificent job!

We are thinking also of another small group to whom SO MANY OWE SO MUCH. We are thinking of the Operating Men in the field of petroleum transport who have kept the truck tanks and trailers rolling day after day, night in and night out, fair weather or foul, good roads or bad, under the most trying conditions ever known. We are thinking of the efficiency, the ingenuity, and the resourcefulness they have demonstrated in maintaining in service truck tanks and trailers which, under ordinary circumstances, would have been junked or traded-in long, long ago.

We are thinking how, unsung and unseen, these Operating Men have made it possible for these tanks and trailers to travel longer distances, stay on the road longer hours, and transport far greater loads than was ever before considered possible.

So here's a mighty cheer for the Operating Men!

FARRELL

MANUFACTURING COMPANY

Joliet, Illinois

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THE COMPLETE SUN LINE
America's 4 million trucks — working harder than ever before in history — are your No. 1 market today. What's more, they are the customers you need to build the foundation now for a profitable future business.
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Sun Chassis Lubricants — More than 60 greases and bases for every truck and automotive requirement.
Sun Gear Lubricants — Tough, durable gear lubricants for all transmission and differential services.
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ECHNOLOGY DEPT.

NATIONAL PETROLEUM NEWS

Monthly Technical Section Devoted to

REFINERY MANAGEMENT *and* PETROLEUM CHEMICAL TECHNOLOGY

DETROIT

Section Two **February 2, 1944**

In the new pipe still unit at the Baltimore refinery of Standard Oil Co. of New Jersey, the naphtha and kerosine side streams as withdrawn from the fractionating tower accumulate in drums (shown at the side near the bottom of the fractionator), are partly cooled in heat exchangers (foreground), and are then returned to the tower as reflux. Any excess material goes to stocks storage. This practice, now becoming conventional, saves in pumping costs over the former practice of running products to storage and withdrawing that needed as reflux material.

The fractionating tower is 108 ft. high. The upper section is 12 ft. 6 in. in diameter, middle section 16 ft. 6 in., and the bottom stripping section (not visible) 5 ft. 6 in. The tower has 34 fractionating and 4 stripping plates. Process design of the pipe still unit was by Standard Oil Development Co., engineering and construction by Arthur G. McKee & Co., refinery engineers.

Octane Number Increase Will be at Progressively Slower Rate than in Past

D. P. Barnard

IN THE above succinct prognosis, D. P. Barnard, Whiting, Ind., Associate Director of Research for Standard Oil Co. of Indiana, summed up the postwar motor fuel outlook for the automotive engineers meeting in Detroit Jan. 10-14 for the annual convention of their Society of Automotive Engineers.

His statement was based on data produced in the A.P.I. Hydrocarbon Research Project, started six years ago to study the properties of individual petroleum hydrocarbons in the gasoline range. The project has provided valuable help in the wartime aviation gasoline program. For the refiners considering the future manufacture of motor fuel, the data indicate that, while each unit of octane number increase up the scale is progressively more important in engine improvement, each octane number likewise is progressively more difficult to produce. (*See p. R-57-60*).

Dr. Barnard, who is chairman of the Hydrocarbon Research Committee, has also for many years been active in the fuel research work done co-operatively by the petroleum and automotive industries. His scholastic training was received at the University of Delaware and Massachusetts Institute of Technology. At the latter institution he was Assistant Director in the Research Laboratory of Applied Chemistry from 1923 to 1925. Then he became associated with the research department of Standard of Indiana and was made Associate Director of Research in 1938.

Laboratory work in the Hydrocarbon Research Project is being done at Ohio State University, under the direction of Dr. C. E. Boord of the faculty. This project is one of seven in fundamental petroleum research sponsored by the American Petroleum Institute.

REFINERY MANAGEMENT *and*
PETROLEUM CHEMICAL TECHNOLOGY

Feb. 2, 1944
Volume 36
Number 5

A MONTHLY TECHNICAL SECTION OF NATIONAL PETROLEUM NEWS *incorporating International Petroleum Technology*

An Informal Long-Range Forecast Of Motor Gasoline Developments*

Both technological and economic factors will limit the improvement of motor gasoline quality in the immediate years to come, and octane numbers probably will not reach 92 (A.S.T.M.) by 1960, these authorities predict.

In discussing further technological refining developments the point of view is taken that motor fuel improvement is basically a problem in chemistry, involving the transforming of undesirable hydrocarbon compounds in crude petroleum into those having the desirable motor fuel qualities of high knock rating and proper volatility.

Data on gasoline hydrocarbons from the research projects sponsored by the American Petroleum Institute are appraised to show the relatively small number of hydrocarbons in the gasoline range which are desirable in their natural form. The greater number must be converted by processing to provide suitable components for improved motor fuels. This transformation must be achieved without appreciable loss of the raw crude and its cost must be supported by the value of the improvement effected so that this cost can be included in the price of the product.

To economically justify the improved fuels, it is pointed out, there must be in general use automobile engines of the type which will realize sufficient benefit from them to warrant the increased cost of their manufacture.

In spite of possible reductions in the crude supply and other problems facing refiners, adequate quantities of gasoline of high quality will be available, these authorities believe. Quality improvements will continue to keep ahead of the demands of car design and construction.

By D. P. Barnard** and R. F. Marschner**

WHILE it may not be universally appreciated, the basic premise for the manufacture of motor gasoline has been, for at least 25 years, that the gasoline quality must be such as to make possible the *greatest number of car miles per barrel of crude* compatible with acceptable and reasonable performance standards. This was the first problem assigned to the Co-operative Fuel Research Committee at the time of its formation in 1921 and is still a major concern of that committee as a division of the Co-ordinating Research Council.

Because of the very large part played by crude costs in the cost of gasoline, the petroleum industry has never been able to stray very far from this fundamental premise, although relatively modest deviations have been permitted in the past when crude has been cheap and available in unrestricted quantities.

Even under such circumstances, however, the basic economics of refining have prohibited extravagances in crude consumption in the interest of gasoline quality improvements. By and large, such quality improvements have been effected concurrently with *improvements in yield from crude*, or, at the worst, at no significant loss in crude.

Motor gasoline may be considered as consisting of two groups of components; those which are highly desirable from the point of view of present ideas concerning knock tendency and volatility requirements and those relatively undesirable components which we seek to change into more desirable ones. An obvious and simple method for accomplishing this might consist in employing a "Maxwell Demon" or some appropriate gremlin to "sort" out the desirable components and relegate to byproduct status the undesirable ones. But such a "sorting" procedure alone would not comply with the requirements for efficient crude utilization. Further, the highest octane number hydrocarbons such as iso-octane simply do not occur naturally to any appreciable extent. Basically, therefore, solutions must be found to the problems of converting undesirable hydrocarbons into desirable ones and for the conversion of other hydrocarbons, not initially within the gasoline range, into desirable ones.

The problem of further motor fuel improvement is basically a problem in chemistry. Therefore, it is necessary to consider the behavior, *as chemicals*, of the individual components of gasoline. There are 5930 possible hydrocarbons in the gasoline boiling point range. As there are so many of these chemical components, and as practical experience has shown their reactions to be extremely complicated, research into the fundamental properties of gasoline hydrocarbons has become a co-operative effort of the petroleum industry.

Currently, the research on gasoline hydrocarbons consists of several separate, but closely co-ordinated projects. American Petroleum Institute Project 6 is engaged in the determination of the hydrocarbons present in gasolines and in their purification and determination of physical properties. A. P. I. Project 44 is critically appraising and correlating the data on the physical properties of gasoline hydrocarbons. The A. P. I. Hydrocarbon Research Project is now in the sixth year of its program for preparing individual gasoline range hydrocarbons in quantities sufficient for engine testing as well as physical and thermal property determination. While this work is far from complete, it is ahead of early expectations and has produced data which can be used in appraising the relations be-

*A portion of a paper under this title presented before the annual meeting of the Society of Automotive Engineers, Detroit, Jan. 10, 1944. The paper is complete except for the introduction which reviewed recent public discussions on this subject, and later footnotes give these references.

**Research Department, Standard Oil Co. (Indiana).

tween hydrocarbon structure and knocking tendencies. The following discussion has been based largely on the results of these projects.

It is generally recognized that the gasoline range hydrocarbons fall in four principal chemical categories: Paraffins, cycloparaffins (or naphthenes), olefins and aromatics. Because of the very significant differences in the chemistry of these different classes they will be treated separately in the following discussion.

A.—Paraffin Hydrocarbons

The paraffin hydrocarbons are, by definition, those in which the carbon atoms are "saturated" with the maximum possible number of hydrogen atoms. They may be considered as either straight or branched chains of carbon atoms to which a hydrogen is attached to every carbon bond not otherwise used as a link to another carbon atom. Those paraffins in which the carbon-to-carbon linkage is a continuous chain are known as "normal" paraffins, while those involving branching of the carbon chain are denoted "iso" paraffins. An important characteristic of all paraffins, and one which results directly from the fact that they are completely saturated with the greatest possible number of hydrogen atoms, is that they have the highest calorific value of any of the hydrocarbons (about 19,000 Btu/lb, net). Light paraffins contain relatively more hydrogen than the less volatile ones.

The total number of paraffins in the motor gasoline range is 650. This number includes a few common straight chain components such as n-heptane having by definition an octane number of zero, and many less common highly branched hydrocarbons such as 2,2,4-trimethylpentane which is familiar to all as reference iso-octane and which has, by definition, an octane number of 100. In between these extremes are the moderately branched paraffins of the intermediate octane number. It is a general rule that the higher the degree of branching the higher will be the octane number. For example, there are 18 octanes; of these there are 4 trimethylpentane (in which 3 side methyl groups are attached to a 5-carbon main chain) which have unleaded A. S. T. M. octane numbers between 95 and 100. All but one of the other octanes have octane numbers more or less progressively decreasing with the degree of branching.

The most highly branched hydrocarbon in the series—variously known as tetramethylbutane, hexamethylethane, or as the "solid octane"—may be considered as having a main chain of only four carbon atoms with four side methyl groups. Its sobriquet of "solid octane" comes from the fact that its *melting* point is 216° F. This octane is strictly a scientific curiosity as far as the present discussion is concerned.

The octane number problem can be exemplified by the octane series. A mixture of approximately equal amounts of all 18 octanes, with the aid of, say, 1 cc of lead, would have an A. S. T. M. octane number of 82. A similar mixture of the 11 most highly branched octanes would give 100 octane number with 1 cc of lead, but the seven which would have to be left out unfortunately include all four which occur in any appreciable amount in petroleum, and a mixture of these four with 1 cc of lead would have only 38 octane number.

From correlations based upon knock data secured by the A. P. I. Hydrocarbon Research Project it is possible to estimate with considerable confidence the octane numbers of paraffins from their chemical structure. For example, it can be predicted that a mixture of all 159 eleven-carbon paraffins, the undecanes, would have 74 A. S. T. M. octane number with 1 cc of lead. The 84 most highly branched of the undecanes, or the best 53% of them, if mixed together in equal amounts, would give 100 octane number with 1 cc of lead.

The difficulty is that not one of these 84 more highly branched eleven-carbon paraffins has yet been seen in pure form. A mixture of the handful of undecanes which have so far been found or made, would have an octane number of only 13 with 1 cc of lead. It is evident that quantity production of 100 octane number gasoline among the undecanes (probably best suited to the requirements of a "high flash" aviation fuel) is still two long steps from reality. Before commercially practical methods of production can be devised, means for synthesizing even small quantities in the laboratory must first be developed.

If we distil a completely paraffinic motor gasoline containing equal amounts of total pentanes, hexanes, heptanes, octanes, etc., up to about 12 carbon atoms, into three approximately equal parts; light, intermediate and heavy, and add 1 cc of lead to each, we would find that if all possible paraffins are present (in equal amounts within each group) the A.S.T.M. octane numbers would be 88, 81 and 75. But if only those paraffins which are already known are present, the octane numbers would be 88, 78, and 30. And if the paraffins are present in the ratios in which they occur naturally, the values would be 68, 24 and below 0.

These comparisons illustrate that especially in the heavy third of motor gasoline, twin problems must be solved to produce a 100 octane number motor fuel; not only is it necessary to prepare the high octane number paraffins, but it is equally important to eliminate the low octane number ones. Suppose that after a great deal of research, a process for re-arranging paraffins throughout the gasoline boiling range were developed. From experimental and thermodynamic data, and with considerable extrapolation, the composition of the resulting mixture of all possible paraffins can be estimated for such an ideal process, operated at, say, 300°F. The light cut would have 87, the intermediate cut about 85, and the heavy cut not far from the same leaded octane number. Even such an ideal process as this fails to give 100 octane number motor gasoline.

From the foregoing, it appears that in order to achieve much higher goals as far as the paraffins are concerned, not only must methods be found for converting a considerable number of the more undesirable isomers into more highly branched and therefore more desirable forms, but also improved volatility, i.e., lower 90% point, becomes a significant part of the problem, and means for converting, say, eleven-carbon paraffins into those of six to eight carbons would contribute considerably to bringing closer the day of quantity production of 90-octane number paraffinic motor gasoline.

B. Naphthene Hydrocarbons

The hydrocarbons next to the paraffins in abundance are the naphthenes. For reasons which do not require elaboration here, it is unlikely that more than two of many possible kinds, the cyclopentanes and the cyclohexanes, need be considered as candidates for the type of gasoline being discussed. As indicated by the prefix "cyclo-", the naphthenes are characterized by a ring configuration, and as a result, they contain two less hydrogens than paraffins of the same number of carbon atoms. They are lower in calorific value by about 3% and their lead susceptibility as a class is poor relative to that of the paraffins.

Since there obviously cannot be a cyclopentane with less than five carbons or a cyclohexane with less than six, naphthenes are of relatively more importance in the intermediate and heavy thirds of motor gasoline than in the light third. Of the 1350 naphthenes in the gasoline range, only eight, with an average A.S.T.M. octane number of 85 with 1 cc of lead, are of light gasoline volatility. Because of the paucity of knock data, little can be said of the heavy gasoline naphthenes beyond the fact that they range from below zero to above 90 octane number with 1 cc of lead, but, in the intermediate range, correlations (again based largely upon data secured by the A.P.I. Hydrocarbon Research Project) have outlined the potentialities involved. A mixture of not more than 13% of the possible intermediate naphthenes is likely to have 100 A.S.T.M. octane number with 1 cc of lead, and none of these is as yet known. Those which are known have, in a mixture of equal quantities, 75 octane number with 1 cc of lead, and those which have been knock rated average 71 octane number with 1 cc of lead.

Thus there is a definite possibility for securing a limited amount of 100-octane number gasoline from naphthenic hydrocarbons. The probability of doing so in the near future is considerably less than in the case of the paraffinic hydrocarbons. The principal reason for this is that isomerization reactions among the naphthenes cannot have the potential octane number increase possibilities characteristic of the paraffins.

C. Olefin Hydrocarbons

The olefin hydrocarbons, like the naphthenes, contain less hydrogen than the paraffins, and as a result calorific value and the lead susceptibility are appreciably less, the calorific values being about 2% below the paraffins. Although there are considerable data upon the octane numbers of individual olefins, the detailed effects of structure upon knocking are not at all clear. Part of the reason for this is that there are 3850 olefins which can be considered gasoline. Therefore, it is not possible to predict with certainty the octane numbers of all the members of an entire group of largely untested olefins such as the octenes. The average octane number of tested olefins in a gasoline made up, as in the discussion of paraffins, of equal amounts of pentenes, hexenes, heptenes, octenes, etc., would be 82 A.S.T.M. with 1 cc of lead in the light third of the gasoline, 81 with 1 cc of lead in the intermediate third, and the heavy third, for which few data are available, would be about the same.

Complex mixtures of olefins known to have highly branched structures have octane numbers similar to those of the fractions of this hypothetical motor gasoline. Olefins certainly show smaller variations in octane number with structure changes than do paraffins. For example, the authors know of no data showing an olefin with less than 40 A.S.T.M. octane number with 1 cc of lead but, on the other hand, to their knowledge no olefin tested has had an octane number above 93 with 1 cc of lead. Moreover, lead has little effect on those olefins with clear octane numbers above 80. It seems clear that it will never be possible to produce motor gasoline of 100 A.S.T.M. octane number in quantity from olefins alone.

D. Aromatic Hydrocarbons

The uniformly high clear octane numbers of aromatic hydrocarbons are partly offset by the low calorific value (about 8-9% below the paraffins) and poor lead response, both accompanying the low hydrogen content. Since the simplest aromatic hydrocarbon has six carbon atoms and because they are less volatile than other hydrocarbons of the same carbon content, the aromatics, like the naphthenes, are relatively more important in the intermediate and heavy fractions than in the light fraction of a motor gasoline. A mixture of all 80 possible motor fuel aromatics would be not quite 100 A.S.T.M. octane number with 1 cc of lead; this holds true in both the intermediate and heavy thirds of the motor fuel range. About a third of them should exceed 100 octane number, and not more than one or two are below 90. The importance of aromatics in increasing the octane numbers of olefinic gasolines, for example, is obvious.

Although the aromatic hydrocarbons are common chemicals, they are not abundant from the motor fuel standpoint. The average aromatic content of typical prewar gasolines was not greater than 11%, a value similar to that recently obtained by A.P.I. Project 6 for the average aromatic content of a variety of straight run gasolines. Methods both old and new, for producing aromatic hydrocarbons from hydrocarbons of other classes, are well known, and postwar gasolines will probably contain a little more aromatics than prewar fuels. But these methods have so far been most useful for the preparation of specialties such as toluene and high solvency naphthas.

Perhaps the best-known of these methods involves the "dehydrogenation" of a part of the naphthenes present in a naphtha and, as was pointed out previously, the naphthenes as an entire group are themselves not the most abundant hydrocarbons. Project 6 data and other analyses show that the aromatic content of typical naphthas can be doubled or tripled by such a dehydrogenation process. But the octane number gain is obtained only at a substantial cost in material; the removal of hydrogen from a naphthene involves a minimum loss in weight which can easily be calculated; for the intermediate gasoline range this minimum loss is more than 5%, and in practice it is considerably greater. It is now possible to produce aromatic hydrocarbons from paraffins; the octane number benefits are greater than for naphthenes, but so also is the cost in lost hydrogen.

E. Recapitulation

Paraffins, naphthenes, olefins and aromatics are the hydrocarbons which have long been available in what might be termed motor fuel volumes. Other classes also have been examined as possible fuel components, some of these are familiar chemicals, some are rare, while others which might be expected to show high octane numbers, exist only on paper. But none of these need yet be considered as important motor gasoline hydrocarbons.

The foregoing discussion has considered each class of hydrocarbon separately whereas the motor gasoline of the future, like the motor gasoline of the past, will be mixtures of all the four classes mentioned. Whether the octane number of such a mixture of hydrocarbons of different classes can be exactly calculated from the octane numbers of the individual hydrocarbons may be subject to debate, but the incremental octane number increases which might be anticipated in each of the classes may be combined with assurance that the weighted average is subject to little numerical error. From the estimated extent to which one to two decades of fuel research and development can utilize the maximum improvements which can be made in the various classes of hydrocarbons, it is believed that the motor fuel of 1960 may possibly exceed 88 A.S.T.M. octane number but *probably will not reach* 92 *A.S.T.M. octane number.*

The Volatility Problem

It is generally recognized that a "desirable" motor gasoline, in addition to having a high octane number, is appreciably more volatile than that defined by the Federal specifications. These specifications define the "heavy end" of the gasoline fraction by an "end point" of 437°F. Gasolines made to this limit are generally unacceptable and, to no small extent, give such inefficient performance in service as to offset a large portion of their crude yield advantages. By and large, gasolines have been made to end points of 400°F. or less for such a considerable length of time that the Federal specification limit has largely lost its significance.

The gasoline volatility problem reduces in the main to the separate tasks of keeping vapor pressures down (and, therefore, front end boiling points up) and 90% and end points down and at the same time avoiding undue loss in yields from crude. In other words, performance requirements ask for relatively narrow boiling point ranges while conservation of crude demands that gasoline fractions not be discarded unless the resulting gains in car mileage offset the losses in yield. By and large, therefore, improving volatility—like improving knock rating—must depend on the development of economically justifiable processes for converting the less desirable hydrocarbons into those falling within the desired volatility range.

The nature of this problem can be more forcefully emphasized by comparison with the foregoing discussion of the octane number problem. Dropping the 90% distillation temperature has the direct effect of reducing the number of hydrocarbons remaining in the boiling point range of the gasoline. Further, this effect is very pronounced. For example, of the 5930 hydrocarbons possible within the 400° end point limit (corresponding to a 90% point of, say, 356°F.) only 7% remain if the end point be reduced to 300°F. and only 3% if it be dropped to 250°F. It is obvious, therefore, that volatility improvements can be achieved only if methods can be devised for converting the large hydrocarbon molecules having the higher boiling points into smaller molecules of desired boiling points without loss of the material removed from the larger molecules and without incurring unjustifiable costs.

Very briefly, the fundamental economic requirements of processes for improving the quality of a motor fuel can be defined as follows:

First, a process for converting, say, low octane number normal paraffins into high octane number branched paraffins, or high boiling point material into more volatile components, must be one which will use "poor" gasoline as a raw material and must convert it into a "good" gasoline without destroying more than an inconsequential fraction. In other words, it must possess the characteristics

of a true isomerization process or its equivalent and must merely revise the construction of the hydrocarbons in question without the rejection of significant quantities of material.

Second, processes must be evolved which will convert low grade hydrocarbons (those not in the gasoline range) to gasoline hydrocarbons of the desired octane number and volatility.

Third, *processes must not cause the loss of a significant amount of hydrogen.* The advantages of petroleum and its products over coal, which is chiefly carbon, result from the fact that it contains "fixed" hydrogen with its relatively high calorific value. To lose hydrogen in a process is to waste crude from an energy standpoint. It is just as serious from the point of view of conservation as if the crude itself were to be destroyed. Just how valuable a resource is being destroyed when hydrogen is lost in a process is readily appreciated by anyone who has had to produce and deliver hydrogen.

The "fixed" hydrogen in petroleum also imparts to the otherwise untractable carbon its desirable properties of fluidity, volatility, etc., and, in the case of gasoline, even provides those properties which make it susceptible to octane number improvement through the use of tetraethyl lead. However, the important point to remember is that hydrogen has a calorific value of about 52,000 Btu per pound as compared with 12,000 for carbon. Conservation and economics are directly against any process which involves its waste. And, lest the writers seem to overemphasize the matter of conservation, it should be remembered that during its lifetime the average car consumes over 10 times its weight in fuel.

Fourth, any process, in addition to being efficient from a crude standpoint, must also be operable, its cost being supported by the value of the improvements effected. For example, the various isomerization processes meet the crude conservation requirements completely. However, as they represent a procedure for making "gasoline out of gasoline" (albeit the product is of improved quality) it is very obvious that all of the costs of the operation must be borne by the value of the octane number improvement. Isomerization cannot be afforded unless the cost of the operation can be included in the price of the product. In general, procedures for "making better gasoline out of poor gasoline" will probably be applicable to a relatively small extent and to the most undesirable group of the gasoline range hydrocarbons.

Another factor should be given very careful consideration when discussing octane number improvements, particularly in the present range of interest. This is the well known characteristic of the octane number scale in which, as the numbers become larger, each unit becomes more and more significant. For example, for the interval 69 to 70 octane number, one unit improvement may be considered as permitting an increase of 0.5% in thermal efficiency of the appropriate engine. In the range 79 to 80 octane number the value of one unit in the proceeding terms becomes 1.25% in thermal efficiency, while the change from 99 to 100 octane number is accompanied by a potential increase of 3% in thermal efficiency.

Obviously, these fuel improvements can be used in many ways such as, for example, in permitting supercharging, increases in compression ratio, etc. Discussion of this part of the subject is not within the province of this paper. However, the fact should be borne very clearly in mind that all studies of gasoline improvement, particularly in any attempt to formulate opinions as to the *probable rate* of improvement, indicate that, (a) *it is characteristic of the octane number scale that the importance of an individual unit increases as we proceed up the scale, and* (b) *it is characteristic of the basic chemistry of fuel manufacture that each octane number becomes progressively more difficult to produce.*

Further, from here on it is reasonable to expect that improvements in octane number must bear an increasing amount of scrutiny from the standpoint of cost versus usefulness. An example of the importance of this factor is the utilization of grade 91 by the airlines in the prewar period in spite of the fact that 100 octane number fuel was readily available. It is a cold fact that even in commercial aviation, octane number improvement can stand but a comparatively small premium —with the exception of exceptionally long range operations. Because motor car operation will be even more rigorously subject to the same economic laws as short range air transport, we can only expect that octane number improvements, while being hard to get, must be produced at very low costs. Therefore, an informal prognosis of the rate of gasoline improvement, over such a period as that up to and including 1960, must lead to the conclusion that *octane numbers will increase but at a progressively slower rate than in past.* The present writers will be greatly surprised to see 100 octane number ASTM motor gasoline generally available by as early as 1960. As a matter of fact, even 90 octane number appears very far in the future.

Conclusion

Certain conclusions as to the probable trends in motor gasoline improvement follow from the various recent studies of the subject. Brown and Barnard[1] pointed out that conversion of the available aviation gasoline manufacturing facilities to motor gasoline production might result in octane number improvements of from two to three units in the early post-war period. The discussion of Chayne[2] and Roensch[3] emphasized the fact that the improvement of automobile fuel mileage must be worked out step by step and that considerable time must elapse before acceptable high compression engines can be evolved. Colwell's[4] masterly survey of technical opinion further emphasized the "evolutionary rather than revolutionary" nature of fuel and car improvements. James[5] has shown that the limits (theoretical and practical) beyond which fuel mileage simply cannot be pushed, are closer to present practice than to the fantastic values which have been so blithely bandied about here of late.

The present discussion points out that the possibility of further improvements in octane number or volatility depend on: (a) the development of processes which will convert non-gasoline hydrocarbons into gasoline hydrocarbons of the most desirable type *without significant material loss,* and (b) the general use of power plants which will realize sufficient benefit from the improved fuels to justify the increased costs of those processes which convert undesirable gasoline hydrocarbons into more desirable ones. Any effort to "force" octane numbers beyond these limits could easily result in crude wastage of as much as 9,000,000 barrels per year per octane number gained. As the economics of gasoline production are identical with crude conservation, such operations will probably not occur to any great extent.

If 100 octane number (A.S.T.M.) motor gasoline is ever to be generally available, means must be found for transforming about half of the gasoline range hydrocarbons into others more desirable from the standpoint of octane number and volatility. The basic economics of gasoline manufacture are identical with those of conservation and, therefore, such processes must operate without appreciable material loss as well as at acceptable costs. The authors' guess is that motor gasoline octane numbers will not get much above 90 (A.S.T.M.) by 1960. In any event, it seems fairly well assured that in spite of possible reductions in crude supply and the many other problems facing the petroleum industry, adequate quantities of gasoline of high quality will be available and that quality improvements will continue to keep ahead of the demands of car design and construction.

1—"How Will the 100-Octane Aviation Gasoline Program Affect Postwar Motor Gasoline?" B. K. Brown and D. P. Barnard, before Metropolitan Section, Society of Automotive Engineers, New York, Dec. 2, 1943. See News Section, NATIONAL PETROLEUM NEWS, Dec. 8, 1943, p. 19.

2—"What Will We Do with Postwar Fuels?" C. A. Chayne, chief engineer, Buick Motor Division, before Metropolitan Section, Society of Automotive Engineers, New York, Dec. 2, 1943. See News Section, NATIONAL PETROLEUM NEWS, Dec. 15, 1943, p. 17.

3—Max M. Roensch, chief, Engine Development Section, Chrysler Corp., discussion before Metropolitan Section, Society of Automotive Engineers, New York, Dec. 2, 1943.

4—"The Effect of Wartime Fuel Developments Upon Postwar Automobiles", A. T. Colwell, vice president, Thompson Products, Inc. S.A.E. Journal, Jan. 1944, p. 1.

5—"The Impact of Present Automotive Experience on Future Developments in Fuels and Lubricants", W. S. James, chief engineer, Studebaker Corp., before Chicago Section, S.A.E., Dec. 14, 1943. (As yet not published).

Instrument Piping, Tubing and Fittings Redesigned to Overcome Wartime Shortages*

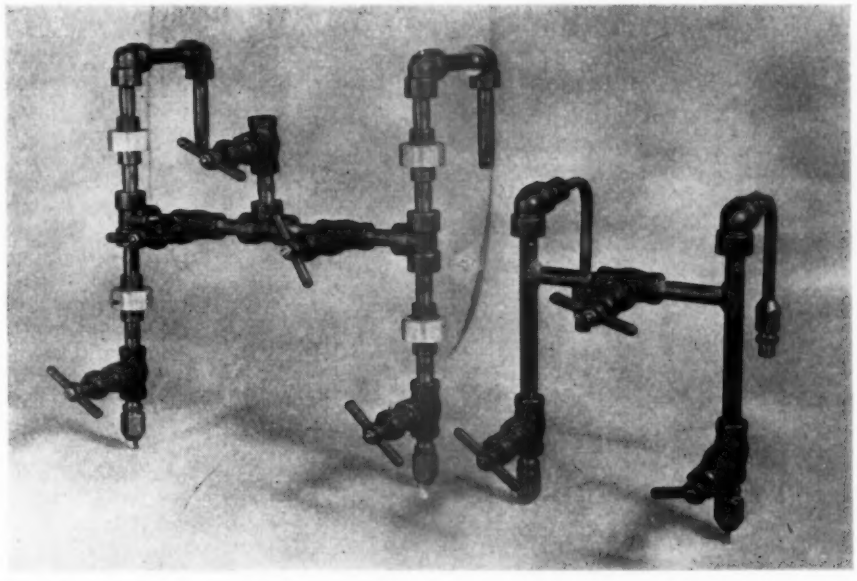


Fig. 3—Left is pre-war by-pass assembly and, right, the emergency assembly adopted to conserve valves and other materials

Changes in the design of instrument fittings and hook-ups in the Institute, W. Va. butadiene plant of the Carbide & Carbon Chemicals Corp. to conserve critical wartime materials are described. The by-pass assembly was changed to reduce the number of valves from five to three, use welded tees, and replace unions by steel tubing fittings. Lighter weight copper tubing was used for instrument leads and indoor copper tubing was replaced by steel tubing.

By Ralph D. Webb**

RATHER than have me try to tell you how to meet the material shortages which have affected instrument piping and fittings, let me discuss what my organization did to meet war conditions on the construction of its part of the synthetic rubber program. Previous to the inauguration of this program we had begun to feel these shortages even in 1940 and were gathering data, changing specifications, and testing various hook-ups in 1941. This work crystallized and the blueprints showing the meter by-pass assembly construction we used were completed at a most opportune time — they were dated Dec. 8, 1941. As you know, this was on Monday and on the following Saturday the first instrument engineering work on the "butadiene from alcohol" plant was started. This got us off to a good start.

With us, the basic instrument is the differential pressure gauge. As a recorder, it is the orifice meter; with control mechanism, it becomes a flow controller which is so necessary to steady operation. It is used to indicate, record and control liquid level, pressure drop, liquid specific gravity, and pressures within a pound or two of atmospheric.

Each of these instruments requires a by-pass assembly at its manometer, and a pair of pressure leads running from the by-pass assembly to the orifice or to the vessel where the pressure differential is being measured.

Number of Valves Reduced

Fig. 1 diagrammatically shows our basic pre-war assembly which consisted of five forged steel valves, four steel unions, and a considerable number of forged steel tees and ells. It represents the cumulation of years—ample unions for easy assembly or for removal for manometer inspection, the three-valve by-pass and forged steel fittings for strength.

We were able to work this over and reduce the number of valves from five to three, reduce the tees and ells to two and to eliminate all unions. Fig. 2 will show you how this final assembly looked.

Note that we resorted to welded tees and that the unions were replaced by tubing fittings. Whereas a high percentage of our differential pressure instruments were of the mercury manometer type, we deemed it essential to use steel fittings and steel tubing to prevent the possibility of mercury amalgamation and consequent destruction of our fittings. Several brands of steel fittings were on the market but have been very hard to procure; consequently, we bought the necessary equipment and had a subcontractor make the standard SAE 45° flared fitting for us, using a mild steel hex stock and finally Parkerized for better corrosion resistance. The steel tubing employed was the same used on the leads, the handling of which I will cover later.

A Difficult Decision

The decision to go to the three valve by-pass assembly was a hard one for us to make. For 20 years we had been using a five valve by-pass, which consisted of two shut-off valves on the leads and with two block valves with a bleeder between on the by-pass. We had worked rather extensively with the various meter valve manufacturers and had found several valves that we felt could be trusted to give tight shut-off. The need to save critical forged pieces justified our taking this chance of a leaking by-pass.

It is usually desirable to incorporate in the by-pass assembly a means of releasing pressure. We felt that the ease with which one of the flared joints could be broken would permit its being used for pressure release, or, in the case of liquid filled leads of venting air bubbles from the high spot. This has proved practical in operation.

In Table 1 is tabulated the materials used in the old and new assembly, show-

*Presented at Symposium on Wartime Problems of Industrial Instrument Departments, American Society of Mechanical Engineers, New York, Nov. 30, 1943.

**Head of Instruments Dept., Carbide & Carbon Chemicals Corp., S. Charleston, W. Va.

TABLE I

	Old Std.	New Std.	Diff.	x 1500
Meter Valves	5	3	2	3000
Forged Elbows	2	2	0	0
Forged Tees	5	0	5	7500
Vent Valves	2	0	2	3000
Steel Unions	4	0	4	6000
Tubing Adaptors	2	6	—4	—6000
Welded Tees	0	2	—2	—3000
Total Forgings	16	5	11	16,500

ing the savings involved in the 1500 by-pass assemblies used. Fig. 3 is a photograph of these two assemblies and gives an idea of their appearance.

For instrument leads we had previously used heavy walled copper tubing, that is, a tubing with about 0.060 in. thick wall. For dry leads we had used the ⅜ in. O.D. size and for wet leads we had used ½ in. O.D. size. We checked carefully over manufacturing data sheets and then assured ourselves by actually testing the tubing fastened between flared fittings. We found that there was a very adequate safety margin if we dropped this wall thickness from 0.060 down to 0.030, which change roughly cut our poundage in two.

Then we ran tests on steel tubing under the pressure of the need for copper conservation. We found we were able to get not only plain carbon steel tubing but also tubing that was classed as tin plated. Exposure tests conducted on the roof of our instrument department buildings indicated that both the tin plated and the unplated tubing became deeply pitted after two months' exposure to our chemical plant atmosphere, which resulted in our rejecting the possibility of using this tubing out-of-doors. We did feel, however, quite justified in calling for its use indoors although doing so did not save such tremendous amount of copper, as our plants are built with practically all equipment outside excepting instruments and compressors; roughly, 70% of the instrument leads were outdoors.

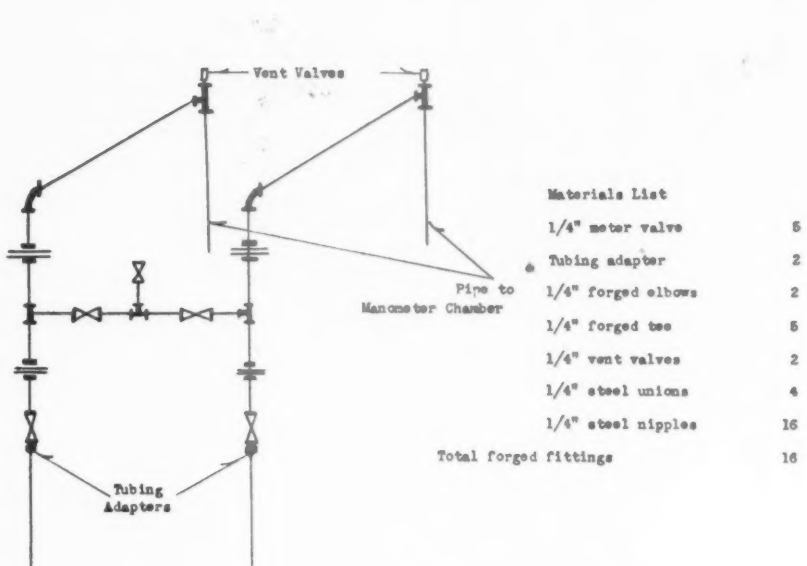


Fig. 1—Pre-war by-pass assembly at manometer of differential pressure gauge

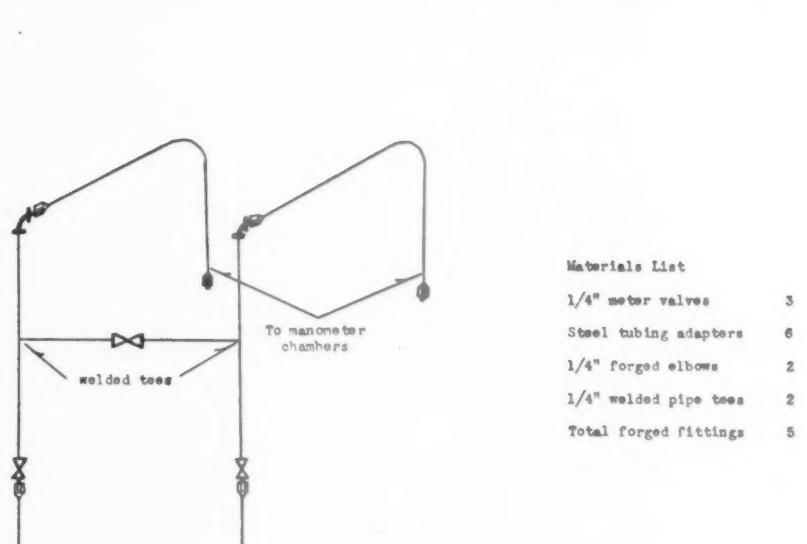


Fig. 2—Revised emergency by-pass assembly, which reduced the number of valves from five to three and in other ways conserved critical materials

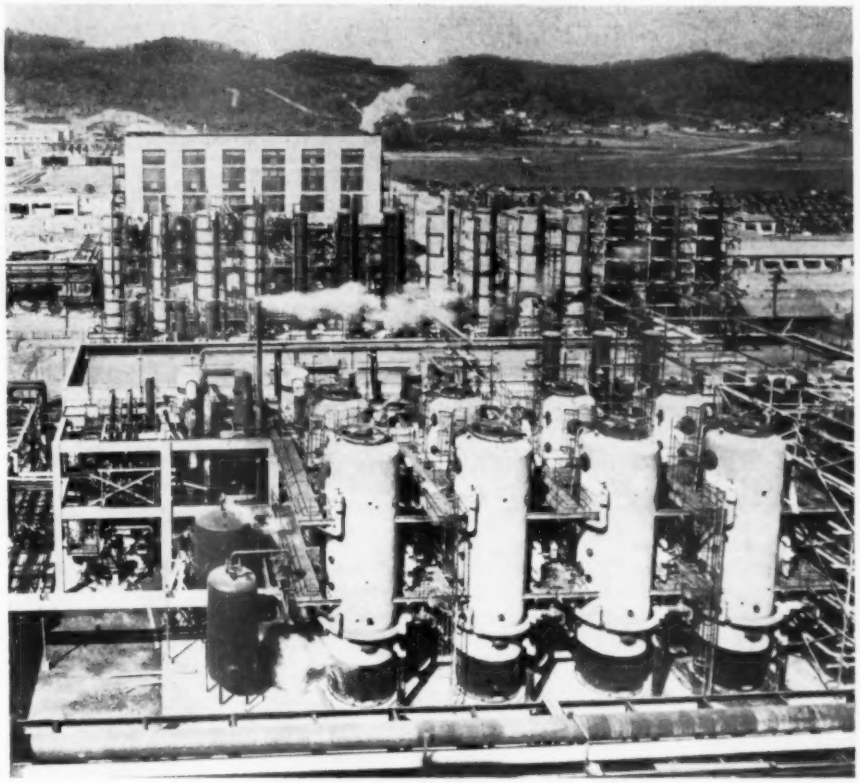
Fitting the Air Connections

For the air connections between controllers and valves we had formerly used the same heavy walled ⅜ in. O.D. copper tubing, the justification for this having been something as follows: Only two sizes of tubing and fittings were necessary, the bulk of which was ⅜ in. size. Many of our air connections were relatively long and we were working under the impression that the ¼ in. size was undesirable under such conditions. By using the heavy walled tubing we did not have to worry about the light tubing being installed on the high pressure leads.

After some tests to assure ourselves as to the adequacy of its size, we adopted the ¼ in. O.D. tubing for all instrument air connections. We started at the air header at the panel board and used it to the instrument and from the instrument to the valve. Also we went from the air header to the valve positioner, but, in most cases, this header was out in the structure and so was rather short. In a few exceptional cases we deviated from this last procedure where large valves which required fast movement were involved, but these cases were so few that we permitted them to go in with the ¼-in. tubing and made the changes later when the small tubing proved inadequate. Again we used steel tubing inside and copper tubing outside and, of course, used quite thin walls.

I might remark that the steel tubing we used on this instrument air service had a light copper plating on the inside and we have found little tendency for this tubing to rust and so produce iron oxide dust.

The fittings we used on the ¼ in. instrument air tubing were of the compression type, that is, the type with the



Butadiene units (in the foreground) and styrene units (in the background) which produce the two basic chemicals for the production of Buna S rubber at the Institute, W. Va., plant of Carbide and Carbon Chemicals Corp.

small brass sleeve, or ferrule, such as is used on the gasoline lines of our automobiles. This fitting was adopted mainly because of its light weight which meant a low poundage of brass. It is also faster to use than is the flared type. As no flaring is required you may wonder why we did not use this same type of fitting for our pressure leads, but we felt that it was inferior in regard to tightness under high pressures and also we did not want to bring the brass sleeve in close proximity with the mercury in the manometers.

30 Tons of Copper Saved

We are quite proud of the fact, and I think it will interest you to know, that at the butadiene and styrene plant we built at Institute, W. Va., our change in standards in instrument piping alone resulted in the saving of approximately 30 tons of copper.

The problem of flaring steel tubing is a tougher one than that of flaring soft copper tubing. When we first gave steel tubing to our fitters they fumbled with it for several days and were very positive in their statements that it could not be flared. We were attempting two types of flares, one of which consisted in the conventional method of merely opening up the end of the tube by means of a conically shaped plug and the other employing a two-step system which is illustrated by Fig. 4. The first step consisted of placing a small piece on the end of the conical plug and merely bulging the tube out as shown. The screw was then backed off, the piece removed, and the flaring completed as shown on the right. You will note that the tube was not stressed at its cut end and we found that our percentage of splits was very low by this method; whereas by the conventional method, which did not fold back the metal, the tube split more than half the time. Incidentally, the little special piece was developed by one of my fitters and I understand that he has applied for a patent on it. We found this flare very strong and when used in the steel fittings gave us very little trouble from leakage. We did not use this type of flare with the copper tubing as it seemed unnecessary and, of course, was slower to make than was the simple flare.

The air distribution headers, which ran behind the panel boards and also out through the valves for positioner air supply, were changed from the old standard of brass pipe and fittings to galvanized.

All of these conservation measures have proved out in practice. The first unit started producing butadiene almost a year ago and today all the units are going at better than rated capacity.

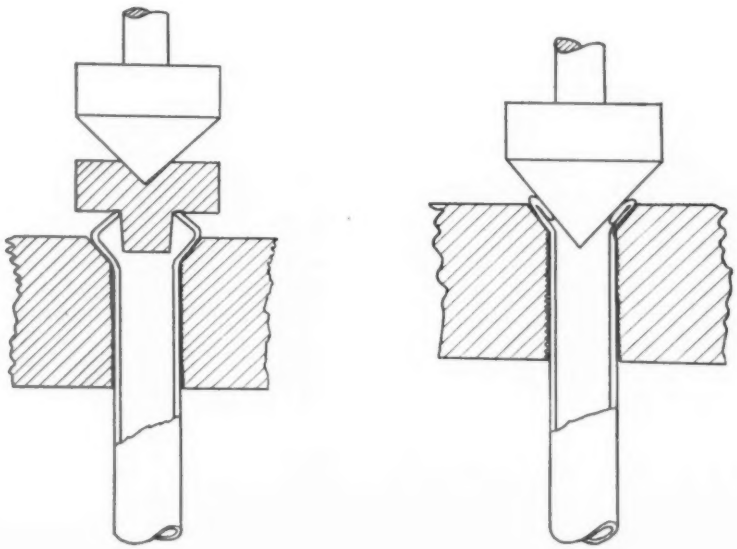


Fig. 4—Two-step method for flaring steel tubing used in control instrument hookup

Use of Natural Gas Components In Refinery Operations*

The modern trend in petroleum refining involves the separation of stocks into individual compounds or classes of compounds and the use of these separated components by blending directly into finished products or as raw materials for specific chemical processes. In its application to the present uses of natural gas and stabilized natural gasoline, this trend has been accelerated by the war in the direction of producing materials such as aviation gasoline. The dependence of the production of high octane components for aviation gasoline on iso- and normal butane from natural gas is illustrated. The production of toluene and the possible production of chemicals and butadiene from natural gas is outlined.

By A. H. Boultbee**

NATURAL GAS and stabilized natural gasoline were originally used respectively as fuel gas and gasoline, without appreciable processing. This followed the usual procedure in the industry where straight-run or cracked products were handled in rather wide boiling range fractions, the boiling range designating whether the fractions were destined for fuel gas, gasoline, kerosine, etc. The demand for increased product quality, together with increased demand for and increased diversification of products derived from petroleum, has, during the past ten years, resulted in a more detailed consideration of the properties and potentialities of the individual compounds present in these wide boiling range fractions.

The application of these considerations to refinery operations has required processes whereby the available stocks are separated into fractions containing the individual hydrocarbons or classes of hydrocarbons. The most common methods for effecting these separations are, of course, distillation, absorption and solvent extraction. After separation the properties of these components can be used to their best advantage either by blending into various finished products or as raw materials for specific chemical processes whereby they are converted into more useful compounds.

Natural gas and stabilized natural gasoline have been in the foreground of this development, because they are relatively simple to break down into their actual hydrocarbons. This is because they are low boiling and straight-run materials and, as a result, contain relatively few hydrocarbons in comparison with higher boiling and cracked stocks. In the following are outlined the present uses of natural gas and natural gasoline with a view to illustrating the application of this trend in petroleum technology. The requirements for war have accelerated development in the direction of producing war materials such as aviation gasoline, with the result that the illustrations emphasize this aspect. Wartime secrecy regulations necessarily restrict this discussion to what is being or can be undertaken without giving process details.

The hydrocarbons present in natural gas and gasoline have two characteristics required for aviation gasoline: namely, within limits, they have a desired volatility and they are inherently resistant to gum formation from atmospheric oxidation. However, besides these two qualities it is essential that aviation gasoline have a satisfactory engine performance which can, at least qualitatively, be defined as having a high A.S.T.M. motor method octane number. The modern trend therefore is to separate natural gasoline into those components most useful for aviation gasoline from the viewpoint of volatility and octane number and to use the rejected components as feed to chemical processes for conversion to more useful components of aviation gasoline or other refinery products.

In order to make the best use of natural gasoline it is therefore desirable to break it down into its individual components and consider the volatility, octane number and potential chemical reactions of each component.

Components Estimated

In Table I is shown an estimated component composition of a composite California unstabilized natural gasoline as received from several fields at a refinery, together with the boiling point and octane number of the individual compounds. Because of the large number of individual hydrocarbons and the difficulty of separating them, the estimated composition may be considerably in error for some of these components. However, it is probable that the table indicates the correct order of magnitude of the component concentrations. The total composition was made to total 100% even though it is realized that a few possible components are ignored and no attempt has been made to estimate the large number of possible hydrocarbons in the high boiling 7% of this gasoline.

Referring to the table, it can be observed that propane, while having an excellent octane number, is very low boiling, with the result that very little can be included in gasoline without exceeding the maximum vapor pressure specifications. Iso- and normal butane also have excellent octane numbers and their boiling points are such that appreciable quantities can be included. However, isopentane, being nearly as good in octane number and appreciably higher boiling, is a more desirable component. If a given aviation gasoline, deficient in volatility, is to be made up to the maximum vapor pressure with one of these components, the relative volumes of these components that can be added are: propane, 1.0; isobutane, 2.9; n-butane, 4.1; isopentane 11.7. Thus a greater volume of finished aviation gasoline will result when the vapor pressure is made up with

Table 1

Boiling Point, Octane Number and Estimated Volume Per Cent of Components Present In A Composite California Unstabilized Natural Gasoline

Compound	B.P., °F.	Unleaded (1) Oct. No.	Vol. %
Methane	—258.5	...	0.5
Ethane	—128.2	...	
Propane	—43.8	100	7.5
Isobutane	+13.5	99	8.5
n-Butane	+31.0	92	28.8
Isopentane	82.4	90.3 (103.5)	11.3
n-Pentane	97.0	61.9	9.9
Cyclopentane	120.9	85 (141)	0.9
Branched hexanes	136-145	73-94	7.5
n-Hexane	155.8	26	3.9
Methyl cyclopentane	161.2	80 (99)	2.4
Benzene	176.2	106 (90.5)	0.7
Cyclohexane	177.4	78.6 (97)	1.1
Dimethyl cyclopentanes	189.5-210.6	89	3.0
Branched heptanes	174-199	45-93	3.2
n-Heptane	209.1	0	1.6
Branched octanes	210.7-246	23-103	
Methyl cyclohexane	213.4	73 (84)	1.5
Toluene	231.3	104 (107)	0.7
n-Octane and heavier	258.3	—17	7.0
			100.0%

(1) Values in brackets refer to blending octane numbers.

*Presented before Eighteenth Annual Fall Meeting, California Natural Gasoline Assn., Los Angeles, Nov. 5, 1943.

**Shell Oil Co., Inc.

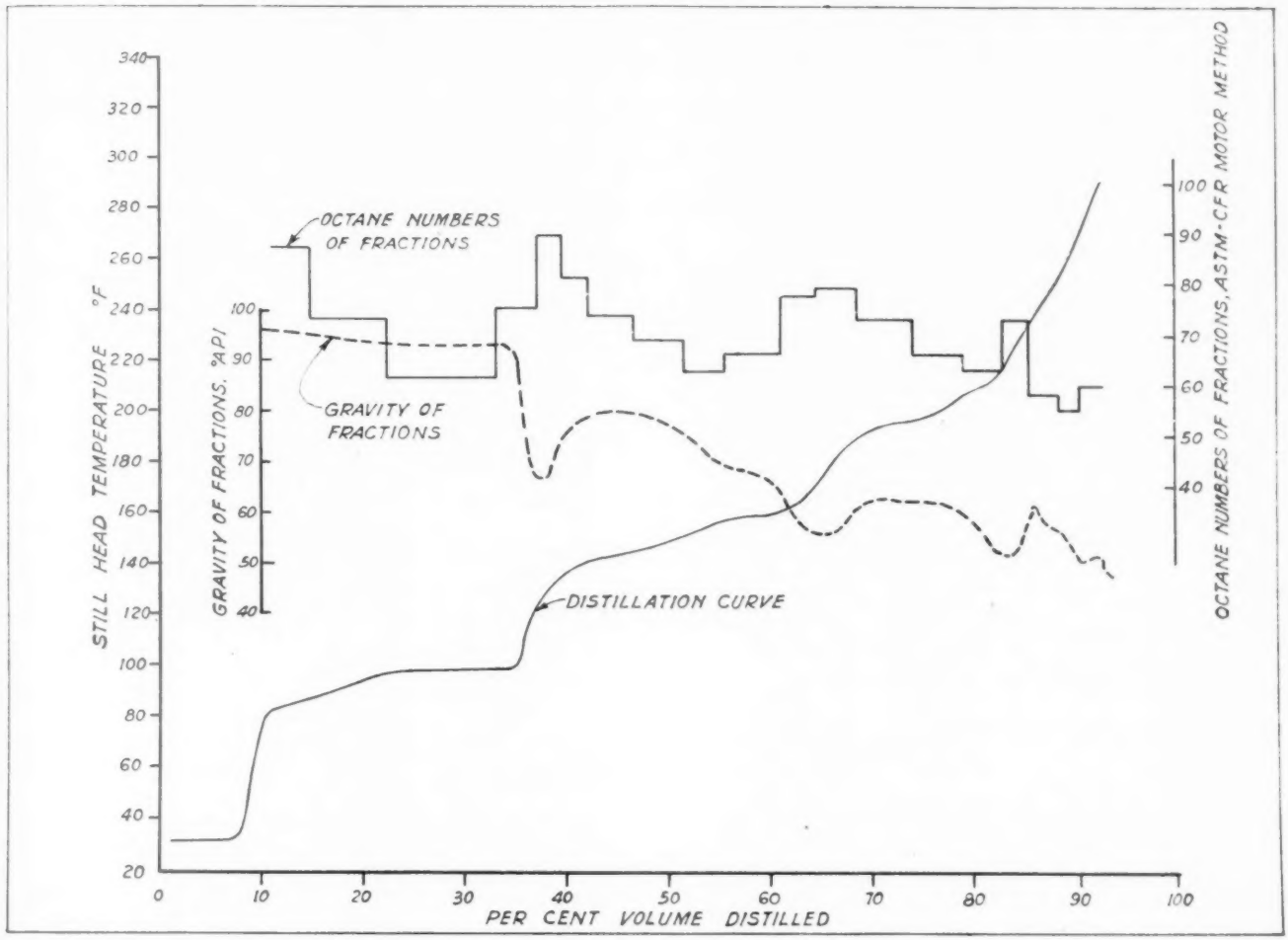

STILL HEAD TEMPERATURE °F
GRAVITY OF FRACTIONS, °API
OCTANE NUMBERS OF FRACTIONS, ASTM-CFR MOTOR METHOD
OCTANE NUMBERS OF FRACTIONS
GRAVITY OF FRACTIONS
DISTILLATION CURVE
PER CENT VOLUME DISTILLED

Fig. 1—Distillation curve from fractionation of stabilized natural gasoline, showing octane numbers and gravities of fractions

isopentane than with any of the other components. For this reason butanes would only be included in aviation gasoline if there were a deficiency of isopentane in the refinery.

Proceeding to the higher boiling components, it can be observed that normal pentane has a much lower octane number than the preceding compounds. For this reason it has been the practice for some years to separate it from isopentane and the higher boiling natural gasoline in order to eliminate it from aviation gasoline. Fractional distillation is used to effect this separation and columns of 80 plates are considered desirable for economic operation. The normal pentane so rejected has been generally diverted to motor gasoline where the octane number requirements are lower than for aviation gasoline. However, recently processes have been developed whereby this normal pentane can be converted to isopentane. The processes employ catalysts and operate at moderate pressures and temperatures. Unreacted n-pentane is separated from the synthesized isopentane by fractional distillation and returned to the process. By this means an ultimate yield of 95% of isopentane can be obtained.

The next higher boiling components of natural gasolines are cyclopentane and branched or isomeric hexanes. In general, these have high octane numbers and are attractive components of aviation gasoline. Cyclopentane is particularly attractive as it has a very high blending octane number. Normal hexane, boiling above the branched hexanes, has a very low octane number and is rejected by some refiners by precise fractionation. However, it is so close in boiling range to other high octane components that it is not practical to make a pure normal hexane reject which would have an octane number of 26. A reject of 55 octane number material is being achieved using towers of 70-80 plates.

Proceeding to still heavier components it can be observed that the normal paraffins are unattractive, that the branched paraffins and cycle paraffins vary in attractiveness and that the aromatic hydrocarbons, benzene and toluene, are excellent components. However, the increasing number of components boiling close together make it generally uneconomic to prepare additional reject streams by straight fractional distillation. With certain types of natural gasoline deficient in cyclo paraffins and aromatics such operation can be attractive, however.

The material in natural gasoline boiling above tolune is of relatively poor octane number and is generally rejected by direct fractionation. The exact boiling point above which a refiner will reject the heavier components will vary with the overall refinery balance and other uses for the heavier components.

Distillation Curve Shown

A graphical picture of the octane number distribution is presented in Fig. 1. This shows a distillation curve from an exhaustive laboratory fractionation of a stabilized natural gasoline, together with the octane numbers and gravities of the fractions.

The first high octane peak corresponds to isopentane and is followed by a low octane valley of normal pentane. The next octane peak corresponds to cyclo pentane and branched hexanes. The dip in the gravity curve indicates the presence of cyclo pentane. The stepwise change from peaks to valleys is because of the limitations of the fractionating equipment which results in fractions containing both the low and the adjacent high octane compounds. The next valley corresponds to normal hexane followed by a peak from benzene and methyl cyclopentane. Again the gravity dip in-

Table 2

(Comparison of Yields of Aviation Components with Different Processes)

Basis: 10 bbl. isobutane
20 bbl. isobutylene
30 bbl. n-butylenes
40 bbl. n-butane

100 bbl. total butane-butylene

35 bbl. propylene } concurrently in
48 bbl. amylenes } other streams

Case	Process	Olefins Type	Olefins Bbl.	Iso-butane Bbl.	Saturated Aviation Product Bbl.	Saturated Aviation Product O.N.	Octane Bbl.	Heavy Non-Aviation By-Product, Bbl.
A	Cold Acid	Iso-butylene	20	None	11	99	1,089	3.2
B	Hot Acid	Iso-butylene n-butylene	20 } 20 }	None None	27.8	98	2,720	4.5
C	Alkylation Same olefins as B	Isobutylene n-butylene	20 } 20 }	54	69	94	6,500	3.2
D	Alkylation All butylenes in charge	Isobutylene n-butylene	20 } 30 }	67	87	94	8,170	4.1
E	Alkylation propylene & amylenes	Propylene Amylenes	35 48	47 65	55 74	88 92	4,850 6,800	3.2 6.7
	Total D and E		133	179	216		19,820	14.0

dicates cyclic compounds. A valley in the normal heptane range, rising to a peak at toluene followed by a valley, conforms in general to the lower boiling pattern but emphasizes the difficulty of using straight fractionation for effecting separation in the higher boiling range.

Demands for toluene for TNT have resulted in the installation of plants for separating it from natural and straight-run gasolines. Ordinary distillation would require a prohibitive number of trays and a prohibitive quantity of reflux to separate the toluene from the non-toluene hydrocarbons. Accordingly, a toluene concentrate is first produced by direct fractionation and the concentrate is then distilled in the presence of a third component, which is generally a non-hydrocarbon polar compound. This component changes the volatility ratio of the toluene and the non-toluene hydrocarbons so that their separation can be effected with an economic number of trays and quantity of reflux. The third component leaves the column with one of these products, is separated therefrom by ordinary distillation on another column, in some cases preceded by an extraction step; it is thence returned to the original column. By such means 90% of the toluene in a concentrate can be obtained at nitration grade purity of 99%.

The foregoing has dealt primarily with the utilization and separation of natural gasoline components by physical methods. In discussing the chemical processing of these hydrocarbons it would be advisable to revert to the development of iso-octane and related compounds as commercial components of aviation gasoline.

Feed stock for the early processes for manufacture of these high octane components was the butane-butylene stream which in turn was a by-product of thermal cracking operations. As demand for these components increased, the supply of the necessary feed stock from thermal cracking became inadequate. In the following, a brief resume is made of developments in this field in order to demonstrate how a changing technology allowed the increased requirements of feed stocks to be obtained from natural gasoline, and to illustrate quantitatively how this resulted in greatly increased aviation gasoline manufacture.

First Iso-Octane in 1935

In 1935 the first commercial iso-octane was manufactured by Shell Oil Co. Inc. at Martinez, Cal. In the original process a butane-butylene stream was contacted with cold sulfuric acid in which the isobutylene was absorbed. The residual isobutylene free butane-butylene stream was rejected to motor gasoline. The "fat acid" was removed continuously and heated to a moderate temperature where separation of a polymer occurred. The lean acid was cooled and returned to the absorption step. The separated polymer was distilled for recovery of an octylene which was subsequently hydrogenated to yield iso-octane.

In 1936 this process was modified in that the contacting was carried out at a moderate temperature. Under these conditions approximately an equal quantity of normal butylene reacted with the isobutylene and a polymer immediately separated. The octylenes so produced were, after hydrogenation, nearly as high octane number as those in the original process (98 compared with 99) and the yield of octanes from a given cracking intake, from which the butylenes were byproducts, was more than doubled. The reason the yield was more than doubled was that the percentage of butylene converted to polymer heavier than octylene in the hot acid process was less than half that produced in the cold acid process.

In Table 2, Cases A and B, is given a comparison of volume yields of high octane product for these two processes. There is also given a comparison of the "octane barrels" produced from a given quantity of feed. The "octane barrels" are obtained by multiplying the octane number of the product by the barrels of product produced. To a first approximation the result can be used as a relative measure of the amount of finished aviation gasoline that can be blended from the products of the processes being considered and the relationship allows comparisons to be made of several processes where both the quantity and octane numbers of the products vary. The U.O.P. selective polymerization process produces results similar to the hot acid process but uses a vapor phase reactor containing solid phosphoric acid catalyst.

In 1938 the alkylation process was developed wherein butylenes and isobutane were contacted with concentrated sulfuric acid; the isobutane and olefin reacted to form saturated hydrocarbons in which octanes predominated. The isobutane had to be present in large excess in order that it would react with the butylene to form a non-reactive product before the butylenes had an opportunity to polymerize. Again the octane number was inferior to that obtained in the other two processes (94) but this was more than compensated for by the increased volume of octanes (including small amounts of other high octane number hydrocarbons) from a given refinery cracking intake. This relative increase over that obtained with the cold and hot acid polymerization processes is shown in Table 2, Case C, wherein the total butylenes reacted is the same as in case B. Again this increase is more than doubled over that with the hot acid process because less butylenes are converted to high boiling material. Moreover, normal butylene is present in refinery gases in excess of isobutylene but its utilization in the polymerization process was limited to an amount equivalent to the isobutylene present.

A Three-fold Increase

Polymerization of amounts in excess of this resulted in a lower octane number hydrogenated product. However, the alkylation process could make use of all the iso- and normal butylenes, thereby further increasing the yield of octanes obtainable from a given quantity of butane-butylene. This is shown in Table 2, Case D. In addition, propylene and the amylenes are being used as alkylation feed stocks thereby producing alkylates somewhat lower in octane number than butylene alkylate (89 and 92 respectively, compared with 94) but yielding a greatly increased volume of alkylate. (Table 2, Case E.) Now sufficient isobutane to alkylate these olefins is not present in refinery cracked gases. Accordingly, recourse to that present in unstabilized natural gasoline was made and its use is responsible for the greatly

increased demand for isobutane recovery in the fields that started in 1938-39.

To illustrate the importance of the isobutane from natural gasoline it can be observed that, from a given quantity of butane butylenes, there is a three-fold increase in octane barrels when converting from the hot acid process to alkylation (Table 2, Cases B and D). Moreover, if the propylene and amylenes concurrently produced in thermal cracking are also alkylated, this increase becomes seven-fold (Case D plus E). However, the isobutane requirement in the latter case is 18 times that available from thermal cracking, and so this increased production of aviation components can only be realized if isobutane from other sources is available. The alkylation reaction not only requires a high isobutane olefin ratio, which is obtained by recycling, but it produces a higher yield of a better quality if the reactor concentration is high in isobutane. For this reason normal butane, which is unreactive and acts as a diluent, was undesirable and accordingly the request to the fields was for isobutane low in propane and n-butane. This purification is of course made in the refinery, where facilities and transportation permit.

The increased demand for aviation gasoline as a result of the war has resulted in the construction of catalytic cracking units which produce high-grade aviation base stock together with large quantities of propylenes, butylenes, and amylenes. To alkylate these olefins requires larger quantities of isobutane than are available in the fields. Accordingly, concurrently with the construction of the catalytic cracking units, there has been the construction and operation of butane isomerization plants. These plants are similar to those mentioned above for pentane isomerization. To provide feed stock for these plants recourse has been made to the normal butane in unstabilized natural gasoline.

From the aforementioned outline it can be seen that alkylation is limited to the quantity of olefins available as byproducts from cracking units. However, since 1941 commercial operation of butane dehydrogenation plants has been carried out whereby butanes are converted to butylenes. In this process iso or normal butane or a mixture of the two is passed over a catalyst at elevated temperatures and low pressure. Unconverted butanes are recycled for an ultimate conversion to butylenes of 80%. Thus, alkylate is being produced directly from natural gas components and so can be made independent of other refinery operations, such as cracking intakes. While not in commercial use, this process can also be applied to the production of propylene from propane and probably for amylenes from n-pentane.

For a number of years organic chemicals have been produced from the low boiling olefins obtained as a byproduct of thermal cracking. Thus, propylene from thermal cracking has been used as raw material for manufacturing isopropyl alcohol, acetone, mesityl oxide, methyl isobutyl ketone, diacetone alcohol and isopropyl ether. Butylenes from the same source have been used to produce secondary and tertiary butyl alcohol and methyl ethyl ketone. Recently, cumene for use as an aviation gasoline blending component has been manufactured from propylene and benzene and butadiene for synthetic rubber has been manufactured from butylene. The above is only a very short list of the commercial organic chemicals that can be and are being manufactured from the low boiling olefinic hydrocarbons.

Competition for Material

The demand for these chemicals has to compete for the olefinic raw material with other demands for these raw materials such as aviation gasoline as outlined earlier. Moreover, since most of the available olefins are byproducts of cracking operations, their availability is dependent on the demand for other cracked products such as motor gasoline. However, by use of the aforementioned dehydrogenation process the olefinic raw materials can be produced directly from components of natural gas independently of cracking operations and in greatly increased quantities. As many of these chemicals are, in their turn, raw materials for the plastic and synthetic fibre industries, it is possible that natural gas utilization will tend in this direction as postwar markets develop.

Reference has already been made to the separation of toluene from straight-run gasolines, including natural gasoline. Processes are also in use in which fractions of straight-run and natural gasoline distilling in the toluene range are treated catalytically to produce synthetic toluene from the other hydrocarbons present. The synthetic toluene so produced, together with the natural toluene originally present, is then separated in nitration grade purity from the unconverted or non-reactive hydrocarbons by distillation with a third component as discussed above. Liquid extraction has also been used to separate toluene from non-toluene hydrocarbons. The addition of synthetic toluene manufacture to the natural toluene recovery increases by several fold the amount of toluene that can be obtained from a given quantity of natural gasoline. While this process is primarily designed to produce toluene for TNT, the toluene can be diverted to aviation gasoline. The reject from the toluene process is material having an octane number of less than 65 and contains much of the normal heptane in the original charge. Thus a separation and rejection of low octane number components has been made, and concurrently compounds having only fair octane numbers have been converted to toluene which has a high octane number (107).

The plants designed for producing synthetic or natural toluene may be converted to the production of synthetic and natural benzene if sufficient demand should develop for the latter product.

In review, therefore, the current uses of natural gas and gasoline components can be summarized as shown in Table 3. It is apparent that natural gasoline components are playing a major role in the production of materials required for the successful prosecution of the war and can become an important raw material in the postwar synthetic organic chemical industry.

Table 3

(Natural Gas and Gasoline Components and their Current Uses as Feed Stocks and Raw Materials)

PROPANE: As fuel (including liquefied petroleum gases), but can be converted to propylene as soon as economic considerations warrant it. Propylene in turn is a raw material for alkylation, or for chemical manufacture such as isopropyl alcohol.

ISO-BUTANE: As alkylation feed stock, whereby it becomes a key component in aviation gasoline manufacture.

N-BUTANE: As feed to isomerization plants, whereby it is converted to isobutane. Alternatively, it is being converted to butylenes, thus becoming the other principal alkylation feed stock supplementing butylenes from other sources. As such, it contributes to aviation gasoline manufacture but can alternatively be diverted to the manufacure of butadiene for rubber or to butyl alcohol, ketones and other chemicals.

ISOPENTANE: Used as such as a key component in aviation gasoline because it combines desired octane number with desired volatility.

N-PENTANE: Separated and relegated to motor or second-grade aviation gasoline. Alternatively, is to be used as feed stock for isomerization plants whereby it will be converted to isopentane.

FRACTION DISTILLING ABOVE 122° F.: Used as aviation base stock with or without rejection of normal hexane concentrate and rejection of high boiling ends to motor gasoline. This base stock together with straight-run base stock is blended with other high octane components, e.g. isopentane, alkylates, etc. to produce finished aviation gasoline. These base stocks are frequently of the order of 50% of the finished aviation gasoline.

FRACTION DISTILLING IN THE TOLUENE RANGE (231.3° F.): As feed stock for natural and synthetic toluene plants, the toluene being used for manufacture of T.N.T. or alternatively, used as a desirable blending agent for aviation gasoline.

Refinery Processes for War Products*

Engineers Discuss How New Processes Have Stepped UP Production of Aviation Gasoline from California Crudes

The roles that refinery processes have assumed in wartime are reviewed, with emphasis on the production and utilization of the fractions falling within the natural gasoline boiling range in increasing the volume of 100-octane gasoline output. While conventional pre-war processing with thermal cracking produced relatively small amounts of aviation gasoline (91-octane), wartime processing with thermal cracking with the addition of alkylation and isomerization operations produces much higher yields of a higher quality aviation gasoline. Modification of the crude distillation and thermal operations to include catalytic cracking of gas oils again greatly improves the yield and produces a surplus of isobutane. Operations in the above three stages are illustrated by describing the handling of 10,000 bbl. of selected 31-gravity California crude. A portion of the original text together with some illustrations is omitted in this presentation.

By F. D. Parker and E. G. Ragatz**

CALIFORNIA wartime refining operations have been markedly influenced by aviation gasoline demand. Since aviation gasoline production is closely allied with natural gasoline operations, our process review will focus primarily on its production. To facilitate the presentation, we will follow the handling of 10,000 bbl. of a selected 31° A.P.I. California crude through 3 stages of processing, extending from conventional pre-war operations to latest catalytic cracking operations for high yield production of aviation gasoline.

Table 1 shows a straight-run distillation breakup of the selected crude into propane and lighter fractions, light straight-run gasoline, heavy straight-run naphtha, gas oil, and residuum. Typical percentage yields and characteristics of the distillate fractions as they influence aviation gasoline production are given.

Conventional Pre-War Processing of Crude Oil Fractions

In the conventional pre-war processing of crude oil for primary products, (i.e., motor gasoline, stove oil, distillate fuels, and residual fuels) with only a small amount of aviation gasoline production, the following operations were adequate to meet product yield and quality requirements: Crude fractionation; thermal reforming; thermal gas oil cracking; thermal viscosity breaking. A brief review of these older processes appears in order, since they still have a definite place in wartime operations.

In a crude oil distillation unit, crude oil is processed and fractionated in conventional distillation equipment to produce light straight-run gasoline, heavy naphtha, gas oil, and heavy residuum cuts of the character outlined in Table 1. The light straight-run gasoline would be stabilized in a conventional unit and then used for either motor or aviation gasoline blending.

In a typical once-through thermal reforming or cracking operation materials such as straight-run naphtha are subjected to cracking temperatures and pressures to produce higher octane cracked gasoline, gas, tar and coke. The feed charge is introduced directly into the coils of the heater, all cracking is effected in the heater coils, the high pressure carried on the heater coils is reduced ahead of the combination evaporator and bubble tower, and a recycle stream of gas oil is used to quench the products leaving the fired heater for the purpose of controlling coke accumulation at the pressure reducing valve and in the transfer line to the evaporator.

In a two-coil recycle thermal cracking and vis-breaking operation, a combined stream of gas oil and residuum from the crude distillation unit is introduced into a combination evaporator and bubble tower for separation into heavy and light cracking coil charge streams. The streams are then treated in separate fired heaters under their respective optimum controls. The cracked streams leaving the two fired heaters are combined into a single stream for introduction into the base of the evaporator. The charge stream of the light cracking coil contains both virgin and cycle gas oil. The quantity of gas oil recycled to this coil can be varied to give greater or smaller overall thermal cracked gasoline yields—thus providing flexibility for the process. As with the simple, once-through operation, recycle gas oil is used for quenching the high temperature streams leaving the cracking coils. As an alternate operation, the gas oil and residuum streams would be separated at the crude distillation unit and cracked separately.

Fig. 1*** presents a simplified block and line flow diagram showing charge and product quantities for a typical pre-war refinery operation utilizing crude distillation, thermal reforming, thermal gas oil cracking, and residual viscosity breaking for the production of motor gasoline fractions, distillate and residual fuel fractions, and a relatively small amount of aviation gasoline. Basis for the quantities presented is a 10,000-bbl. throughput of the selected 31° A.P.I. California crude of the composition shown in Table 1. It will be noted that this operation produces only some 6.7% of 91-octane aviation gasoline, even though all usable straight-run material is diverted to aviation gasoline production. All thermal butanes and pentanes, as well as the heavier thermal cracked gasoline fractions, are used to impart desired vapor pressure and knock rating characteristics to motor gasoline.

In connection with the indicated yields and product quantities of this flow diagram, as well as others to follow, it would be understood that all secondary production quantities and losses have been ignored in order to simplify the overall process comparison.

War-Time Processing of Crude Oil Fractions With Thermal Cracking

As noted above, the conventional pre-war refinery equipped for early peacetime operations was provided with crude fractionating and thermal cracking facilities only. As the demand developed for

*Principal portion of a paper under this title presented before the Eighteenth Annual Meeting, California Natural Gasoline Assn., Los Angeles, Nov. 5, 1943.

**Chief Process Engineer and Process Engineer, respectively, Bechtel-McCone-Parsons Corp., Los Angeles.

***The numbers of figures as shown here do not correspond with those in the original paper, since several illustrations have been omitted.

TABLE 1—Typical Breakup of a Selected 31° API California Crude for Aviation Gasoline Production

Fraction	Reid V.P. Lbs/Sq. In.	Octane CFR-M Clear	Vol. % Basis "O" Loss
C_3 and Lighter	..	..	0.35
Iso-Butane	77	99	0.20
Normal Butane	52	92	0.70
Iso-Pentane	21	90	0.60
Normal Pentane	15.5	61	0.75
C_5 - 250° Light S.R. Gasoline	5.5	72	5.40
225 - 450° Heavy S.R. Naphtha	1.5	55	24.00
Total Gasoline and Naphtha Fractions	..	..	31.65
450°-700° Gas Oil—41 SSU @ 100° F.	..	..	32.0
700° Initial Resid.—100 SSF @ 210° F.	..	..	36.0

A LESSON IN WATER COOLING

(Write for this complete series of "Lessons")

HOT AIR RECIRCULATION

"Hot air recirculation" is an undesirable condition which occurs at intervals or continuously in those mechanical draft cooling towers not properly designed to prevent it. It is the re-entry, into the tower's fresh air intakes, of discharged air which is heat-laden from previous passage through the tower.

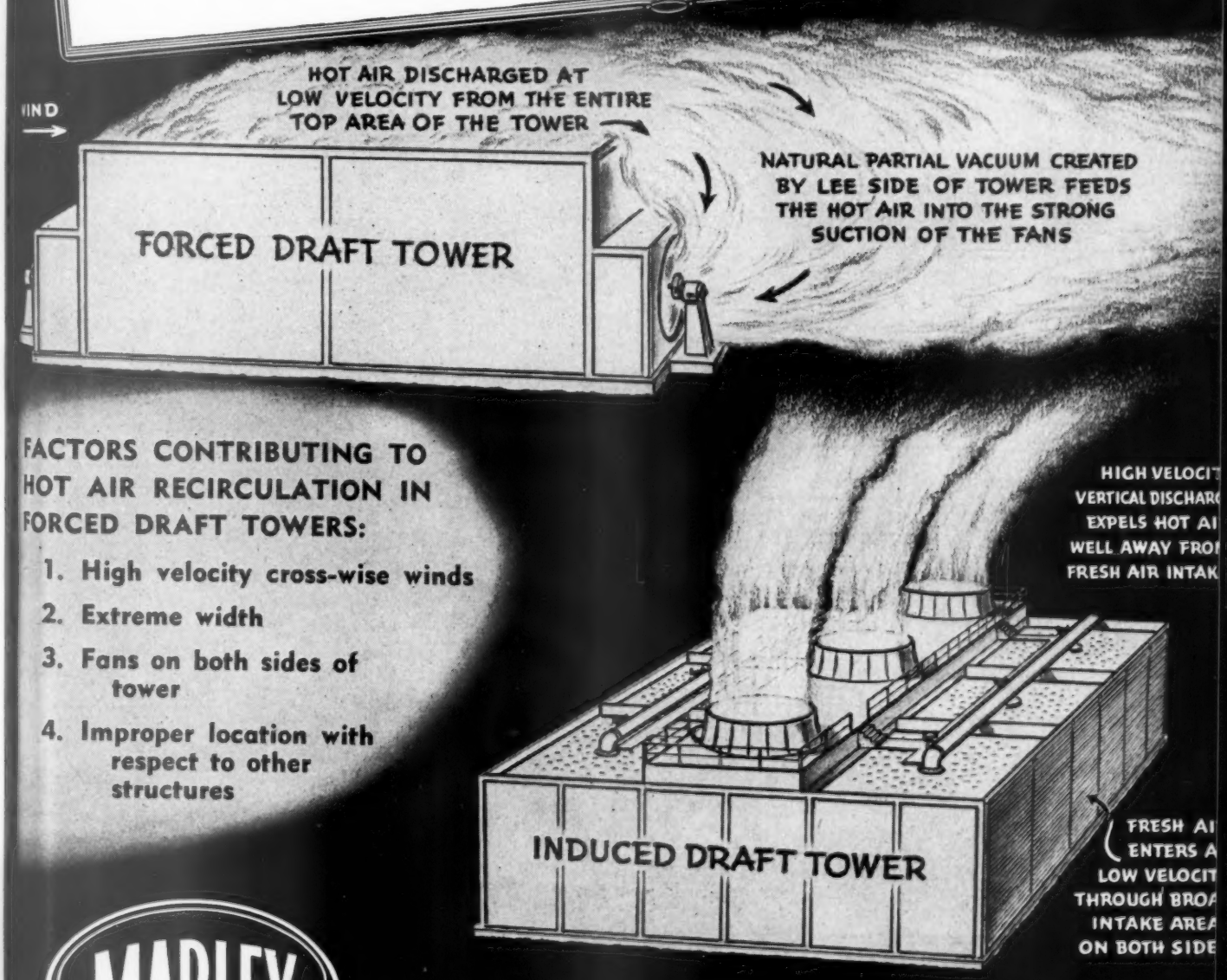
The net result of recirculating hot used air is to increase the wet bulb temperature and total heat content of the entering air. Its effectiveness as a cooling medium is thus reduced, causing the water temperatures to rise.

Recirculation of hot air increases water temperatures from a fraction to as much as 6 or 7 degrees in extreme cases. The following example is typical of the effect of recirculation upon cooling tower performance and investment:

	Performance as Designed	Performance with Recirc.
Hot water temperature	98 F	100.0 F
Cold water temperature	80 F	82.0 F
Wet Bulb temperature	73 F	75.5 F
Loss of tower effectiveness	0%	15%
Loss of investment	0%	15%

This negative feature of mechanical draft cooling towers is confined almost entirely to the forced draft type, particularly those having large fans and great width. The low discharge velocity of the hot used air leaving the broad top area of the forced draft tower permits it to be easily blown, by external winds, into the suction of the forced draft fans.

The induced draft type of cooling tower, with fans discharging vertically at great velocity, expels the hot used air high into the atmosphere and away from the fresh air inlets.


WIND
HOT AIR DISCHARGED AT LOW VELOCITY FROM THE ENTIRE TOP AREA OF THE TOWER
NATURAL PARTIAL VACUUM CREATED BY LEE SIDE OF TOWER FEEDS THE HOT AIR INTO THE STRONG SUCTION OF THE FANS
FORCED DRAFT TOWER
FACTORS CONTRIBUTING TO HOT AIR RECIRCULATION IN FORCED DRAFT TOWERS:
1. High velocity cross-wise winds
2. Extreme width
3. Fans on both sides of tower
4. Improper location with respect to other structures
HIGH VELOCI
VERTICAL DISCHARG
EXPELS HOT AI
WELL AWAY FRO
FRESH AIR INTAK
INDUCED DRAFT TOWER
FRESH AI
ENTERS A
LOW VELOCIT
THROUGH BROA
INTAKE AREA
ON BOTH SIDE

MARLEY COOLING TOWERS

THE MARLEY COMPANY INC.
KANSAS CITY, KANSAS

larger quantities of aviation gasoline of higher quality than could be produced from straight-run fractions alone, installation of modernized refining equipment was stimulated. The most important items of this modern equipment are alkylation, isomerization, and catalytic cracking units.

In a typical sulfuric acid alkylation unit, propylenes, butylenes, and amylenes are combined with isobutane in the presence of a liquid catalyst (sulfuric or hydrofluoric acid) to produce a high quality aviation gasoline blending agent of relatively low vapor pressure. Feed stock for such units consists of a mixture of olefins and isobutane with some normal paraffins. Isobutane is recycled through the unit along with the incoming feed stock for the purpose of maintaining high ratios of isobutane to olefins in the reaction zone so that polymerization of the olefin portion of the feed may be kept to a minimum.

The reaction takes place in the liquid phase. A large emulsion recycle stream is circulated through a chiller in series with the alkylation reactor for control of reactor temperature. Extensive fractioning equipment is employed in connection with the alkylation plant to effect separation of propane, isobutane, normal butane, and pentanes from the effluent stream, and to segregate the alkylate production into aviation alkylate and heavy alkylate bottoms. Alkylate yields are of the order of 1.5—1.7 times the olefin feed, with isobutane requirements amounting to 0.95—1.25 times the olefin feed.

As the demand for volume production of aviation gasoline increased, it was often found that the supply of olefins from thermal cracking units exceeded the supply of isobutane available for alkylation plant feed. The isomerization process satisfies this deficiency by the conversion of normal butane to isobutane.

Butane isomerization processes operate in either the vapor or liquid phase, according to the requirements of the process in question. Aluminum chloride is the basic catalyst used in all cases. The aluminum chloride may be sublimed and deposited on a solid carrier, or handled as a liquid by forming an aluminum chloride complex or mixture with other materials. In all cases, hydrogen chloride is used as an activator for the catalytic action, requiring facilities for thoroughly drying the incoming feed stream in order to avoid hydrochloric acid corrosion of the equipment. Isobutane yields of the order of 40-50% per pass are obtained, with total conversion yields amounting to over 95% of the net butane charge.

The isomerization process can also be adapted to pentane and hexane isomerization for the direct production of aviation gasoline blending agents. Fig. 2 presents a block and line flow diagram of the original pre-war refinery operation of Fig. 1, modified to include butene and pentene alkylation, butane isomerization, and pentane fractionating operations. Addition of alkylate and removal of normal pentane from the aviation gasoline blend makes it possible to readily produce 100-octane material; olefins, isobutane, and isopentane from the thermal cracking units formerly used for motor gasoline blending are now diverted to aviation gasoline production; and the total yield of aviation gasoline is substantially increased—amounting to some

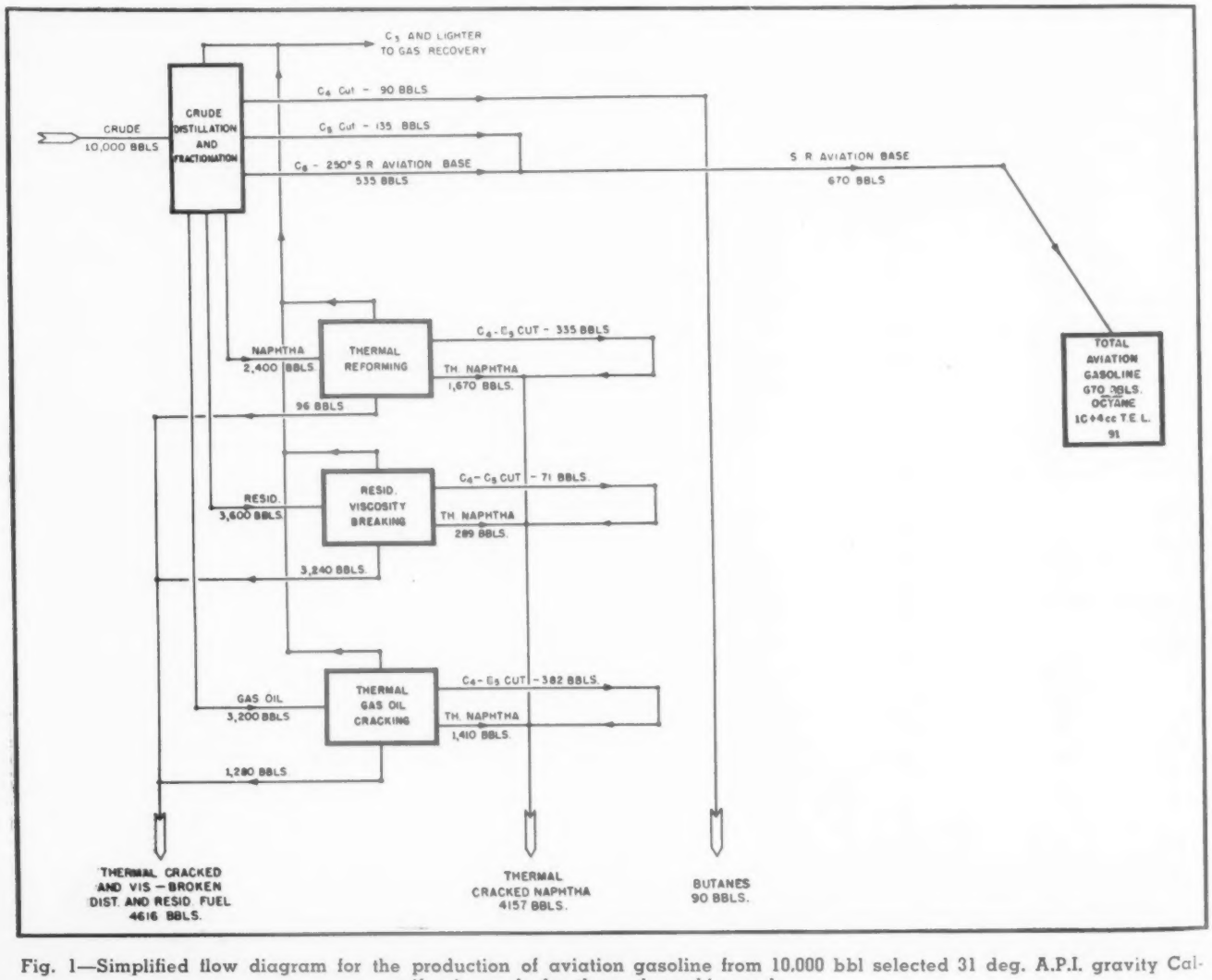

C3 AND LIGHTER TO GAS RECOVERY
CRUDE 10,000 BBLS
CRUDE DISTILLATION AND FRACTIONATION
C4 Cut - 90 BBLS
C5 Cut - 135 BBLS
C6 - 250° S R AVIATION BASE 535 BBLS
S R AVIATION BASE 670 BBLS
NAPHTHA 2,400 BBLS
THERMAL REFORMING
C4 - C5 CUT - 335 BBLS
TH. NAPHTHA 1,670 BBLS.
96 BBLS
TOTAL AVIATION GASOLINE 670 BBLS. OCTANE 1C+4cc T.E.L. 91
RESID. 3,600 BBLS.
RESID. VISCOSITY BREAKING
C4 - C5 CUT - 71 BBLS.
TH. NAPHTHA 289 BBLS.
3,240 BBLS.
GAS OIL 3,200 BBLS
THERMAL GAS OIL CRACKING
C4 - C5 CUT - 382 BBLS.
TH. NAPHTHA 1,410 BBLS.
1,280 BBLS
THERMAL CRACKED AND VIS - BROKEN DIST. AND RESID. FUEL 4616 BBLS.
THERMAL CRACKED NAPHTHA 4157 BBLS.
BUTANES 90 BBLS.

Fig. 1—Simplified flow diagram for the production of aviation gasoline from 10,000 bbl selected 31 deg. A.P.I. gravity California crude by thermal cracking only

TO UNLOCK COUNTLESS DOORS

A "SKELETON KEY" made to open the way for as yet uncounted technological processes is to be found in Porocel activated bauxites. Introduced commercially only six years ago as granular refining agents for petroleum stocks, they have now assumed vital importance as new process tools in Industry. Porocel's catalysts and adsorbents are versatile — but each job (such as the following) is performed with unique specificity.

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Cyclization: Dehydrocyclization to form aromatics
Defluorination: Decomposition and retention of fluorides
Isomerization: *Isocel* prepared catalyst —anhydrous $AlCl_3$ on activated bauxite
Production of elemental sulphur from SO_2 and H_2S
Catalytic cracking

REFINING:

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Refining of sugar solutions
Removal of $AlCl_3$ and HCl from gases and liquids
Removal of contaminants from aqueous wastes

DRYING:

Removal of water from liquids and gases: *Driocel*—a specially prepared bauxite desiccant

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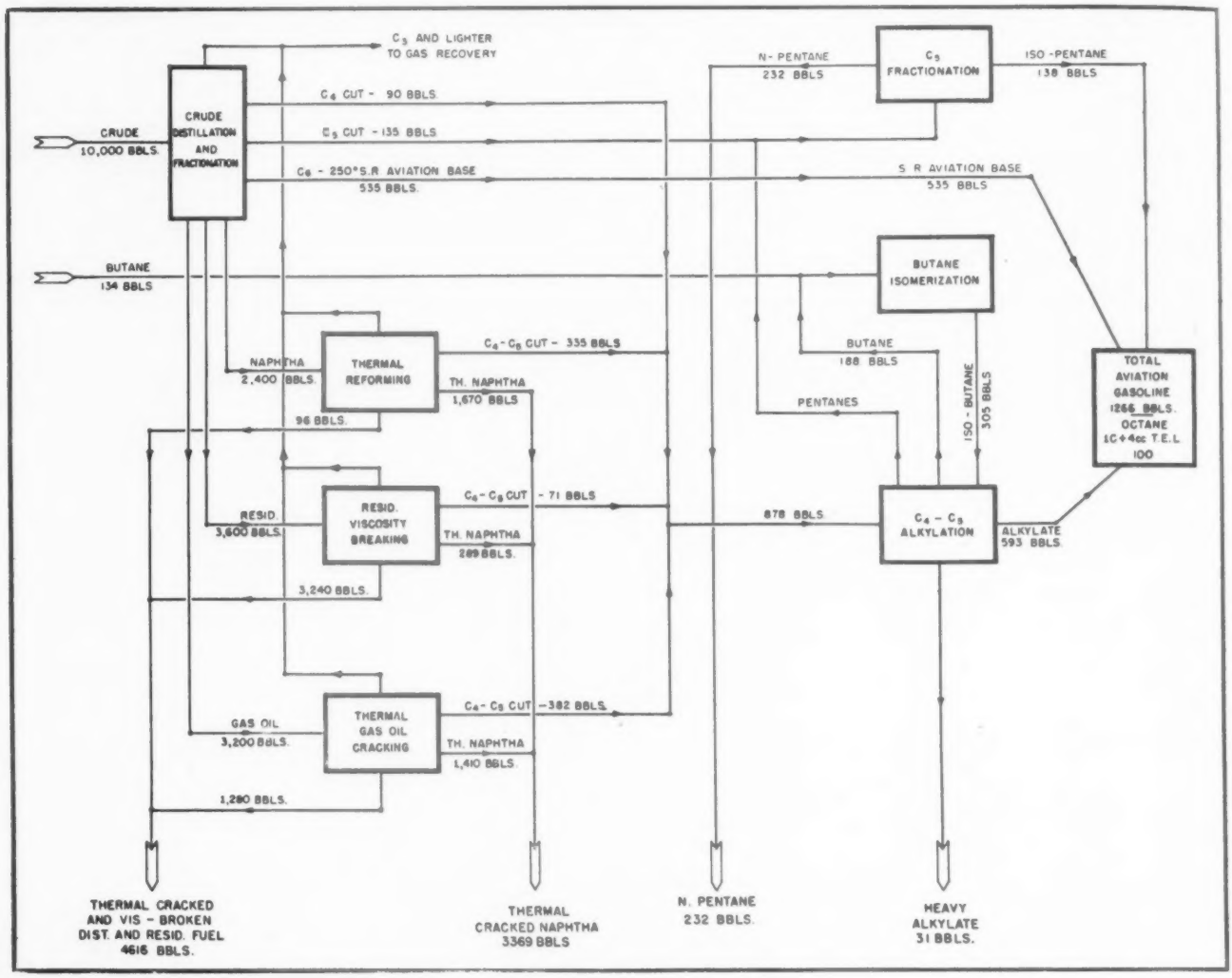
C3 AND LIGHTER TO GAS RECOVERY
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N. PENTANE 232 BBLS.
HEAVY ALKYLATE 31 BBLS.
N - PENTANE 232 BBLS
C5 FRACTIONATION
ISO - PENTANE 138 BBLS
S R AVIATION BASE 535 BBLS
BUTANE ISOMERIZATION
BUTANE 188 BBLS
ISO - BUTANE 305 BBLS
PENTANES
878 BBLS.
C4 - C5 ALKYLATION
ALKYLATE 593 BBLS.
TOTAL AVIATION GASOLINE 1265 BBLS. OCTANE 1C+4cc T.E.L. 100

Fig. 2—Simplified flow diagram for the production of aviation gasoline from 10,000 bbl selected 31 deg. A.P.I. California crude by thermal cracking, plus alkylation and butane isomerization

12.7% of 100-octane gasoline as compared with the original 6.7% production of 91-octane material. In order to achieve this yield, however, the plant-produced butane feed stock for butane isomerization had to be augmented by some 134-bbl. from an outside source.

Though the thermally cracked gasoline contains a large amount of material boiling within the aviation gasoline range, none of this material can be included in the aviation gasoline blend due to its high olefin content. As a consequence, increasing the aviation gasoline production beyond that characterized by the operations of Fig. 2 requires the use of a cracking operation which will produce high yields of aromatics and isoparaffins in place of the high olefin yields of the thermal cracking units. This need is met by catalytic cracking.

Catalytic Cracking Processes

In contrast to the relatively simple process flows of the older thermal cracking units, the process requirements of catalytic cracking cycles appear rather complex. This is due to the fact that coke resulting from the cracking reaction deposits on the catalyst, and must be removed by burning in order to maintain catalyst activity. Methods of heat control, heat recovery, and catalyst handling employed in the regeneration of the catalyst constitute the distinguishing mechanical differences in today's commercial catalytic cracking process.

While differing in methods employed for catalyst handling and regeneration, and in the specific catalyst used, the three commercial catalytic cracking processes in use today; namely, Houdry, Fluid, and Thermofor Catalytic Cracking (TCC) have the following process features in common:

1. All use solid catalysts of the contact or adsorptive type.

2. The catalysts are chiefly natural and chemically treated clays, or synthetic materials of the same general composition.

3. The cracking reaction is effected wholly in the vapor phase in the presence of the catalyst at low pressures of the order of 10 to 50 psi gage.

4. Cracking temperatures of the order of 800-1000° F. and maximum regeneration temperatures of the order of 1100-1200° F. are employed.

5. A circulating cooling system is used to control the temperature of the catalyst during regeneration, and to remove and recover waste heat.

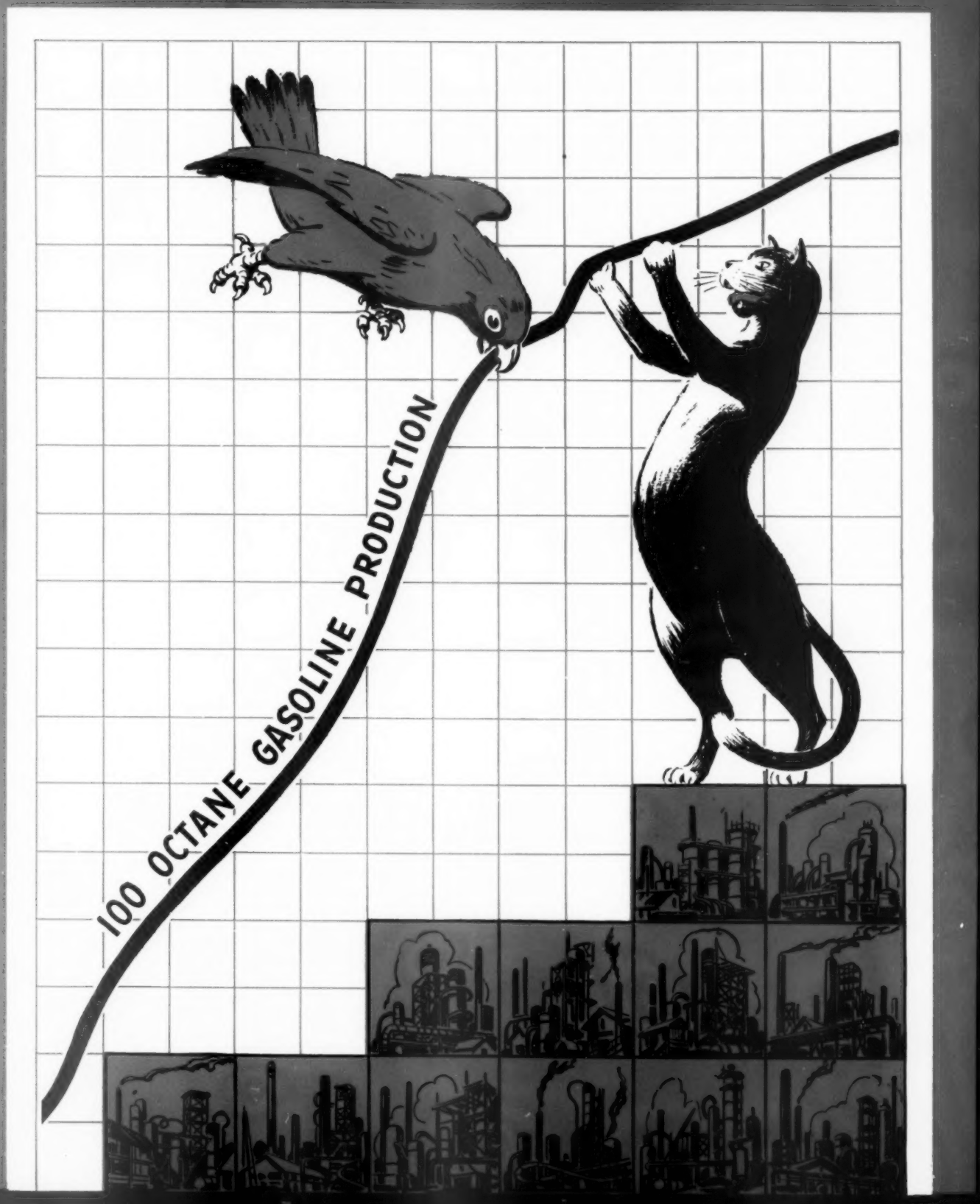
6. The catalyst slowly loses its efficiency in operation and must be periodically or continuously replaced with fresh material.

7. The depth and character of cracking is primarily governed by the specific type of catalyst employed, degree of catalyst activity, catalyst to oil ratio, time of contact, and cracking temperature.

(A description of the operation of the Houdry, Fluid and Thermofor cracking processes is included in the paper at this point but is omitted in this presentation. —Editor)

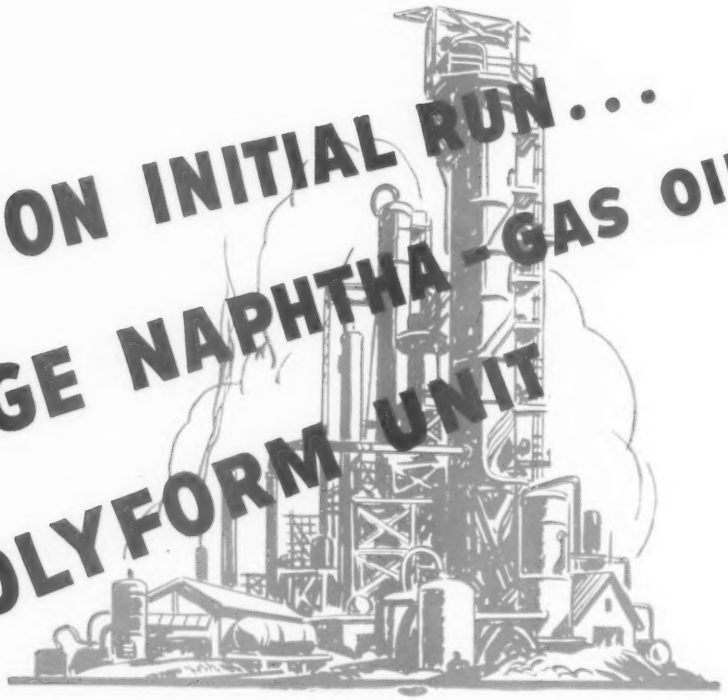
Catalytic Cracking for Aviation Gasoline Production

While details of operation and control vary considerably between the 3 catalytic cracking processes now in commercial operation, the following important generalizations can be made regarding the utilization of catalytic cracking and treating for the production of high qual-



12 went on stream within 60 days

NOW ON INITIAL RUN . . . LARGE NAPHTHA-GAS OIL POLYFORM UNIT



One of twelve Lummus units to go on stream during the past 60 days is this Naphtha-Gas Oil Polyform unit. Lummus crude atmospheric and vacuum distillation units preceded this initial operation and Lummus Furfural, Benzol-Ketone Dewaxing and Clay Contacting Units followed. These units, with all tankage, utilities, docks, etc., were all part of a complete refinery surveyed, engineered, constructed (on a new site) and started up by Lummus. This plant produces aviation gasoline, aviation lube oils and other essential products.

Included in the twelve plants which went on stream during the past 60 days are another Lummus Naphtha-Gas Oil Polyform unit which is part of the largest crude combination cracking unit ever built, three more Lummus Thermofor Catalytic Cracking* plants and two alkylation plants. Within a few weeks, the largest butadiene plant in the world, built by Lummus, will start operations.

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*Licensed by Houdry Process Corporation

LUMMUS

PETROLEUM REFINING PLANTS

ity aviation gasoline components.

1. Highest quality aviation gasolines are produced from naphthenic feed stocks, and lowest quality from paraffinic feed stocks.
2. Increasing the temperature and severity of cracking increases the yields of olefins and isobutane in the lower aviation gasoline boiling range, and the yields of aromatics in the higher boiling ranges.
3. High aviation gasoline qualities and yields are obtained by second-pass treatment of a butane or pentane-free first-pass high end point gasoline cut—with the treating conditions being more severe for the second-pass treating operation than the first-pass cracking operation.
4. The quality increase achieved by second-pass treatment is obtained through elimination of olefins from the lower boiling fractions, and production of additional aromatics in the upper boiling fractions.
5. In addition to producing high quality aviation base stock, two-pass catalytic cracking simultaneously yields substantial quantities of isobutane and olefins for alkylation. High yields of isopentane are also obtained—with this production often being larger than can be utilized in the 7-lb. Reid catalytic aviation gasoline blend.
6. The heavier the charging stock from a given crude source, the higher the olefin yield.
7. Within limits, relative productions of isoparaffins and olefins can be varied by choice of catalyst used, and depths and severity of cracking employed.
8. The 7-lb Reid catalytic aviation gasoline will in general fall within the following quality ranges:

Octane Rating	
A.S.T.M. Clear	77-82
A.F.D.— 1C + 4 cc Tel	92-97
Acid Heat, °F.	10-25
Aromatic Content, Volume pct.	20-30

Superior qualities to above are obtainable from selected charging stocks, or by special processing schemes.

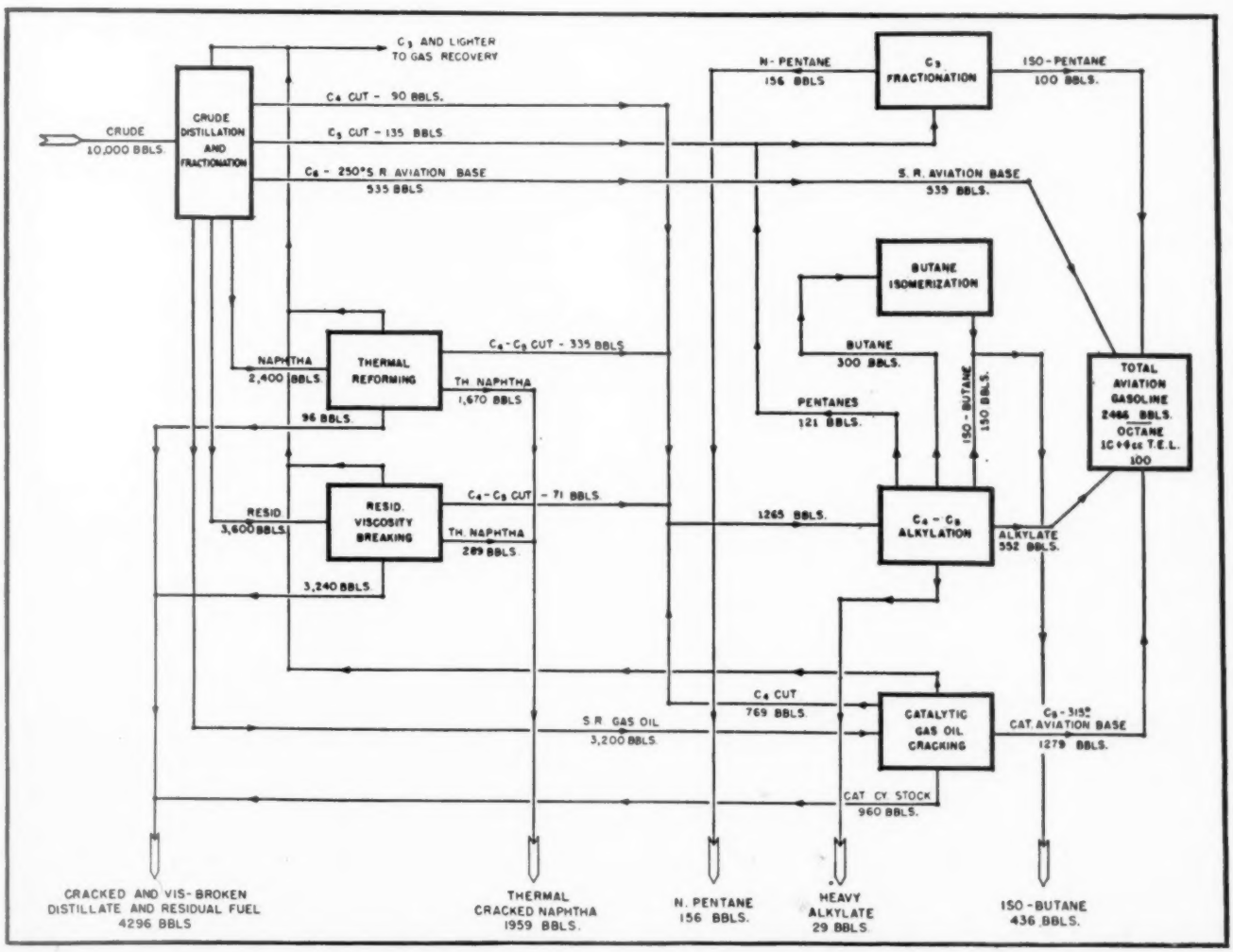
War-Time Processing of Crude Oil Fractions With Catalytic Backing

Fig. 3 presents a block and line flow diagram in which two-pass catalytic cracking of gas oil replaces the recycle thermal gas oil cracking of Fig. 2. With this substitution the production of 100-octane aviation gasoline is again doubled, and a surplus of 436 bbl of isobutane is produced as compared with the 134-bbl butane deficit experienced with the thermal gas oil cracking operation. These figures aptly illustrate the extreme adaptability of catalytic cracking to aviation gasoline production. Not only does the catalytic process provide large yields of high quality base stock, but also high accompanying yields of isobutane and olefins for alkylation, and isopentane for direct aviation gasoline blending.

Summarized Refinery Processing Operations

Table 2 presents a summary of the pertinent figures connected with the processing operations of Figs. 1, 2 and 3 covering:

a. Conventional pre-war crude distil-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BUTANE 300 BBLS.
PENTANES 121 BBLS.
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1265 BBLS.
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ALKYLATE 552 BBLS.
C4 CUT 769 BBLS.
S.R. GAS OIL 3,200 BBLS.
CATALYTIC GAS OIL CRACKING
C8-315° CAT. AVIATION BASE 1279 BBLS.
CAT. CY. STOCK 960 BBLS.
CRACKED AND VIS-BROKEN DISTILLATE AND RESIDUAL FUEL 4296 BBLS
THERMAL CRACKED NAPHTHA 1959 BBLS.
N. PENTANE 156 BBLS.
HEAVY ALKYLATE 29 BBLS
ISO-BUTANE 436 BBLS.

Fig. 3—Simplified flow diagram for the production of aviation gasoline from 10,000 bbl selected 31 deg. A.P.I. California crude by thermal cracking, and alkylation and butane isomerization with the addition of catalytic cracking of gas oil

TABLE 2—Production of Aviation Gasoline From 10,000 Bbls. Selected 31° API California Crude

Components	Quality: Reid V. P. Lbs/in²	Quality: Octane 1C + 4cc-T.E.L.	Production — Bbls.: "A" Thermal Cracking	"B" "A"+ Alk. +C_4 Isom.	"C" "B"+ Cat. Cracking
Aviation Gasoline Components					
C_5 Free Virgin Base Stock	3.5	90.0	535	535	535
C_5 Free Catalytic Cracked Base Stock	2.5	96.0			895
C_4 Alkylate	4.0	i + 0.8		347	400
C_5 Alkylate	2.5	i + 0.5		246	152
Iso-Pentane	20.6	i + 1.5	60	138	436
Pentenes	15.5	74			16
Normal Pentane	15.5	87	75		32
Case "A" — Blended to 91 Octane	6.4	91	670		
Case "B" — Blended to 100 Octane	5.2	100		1266	
Case "C" — Blended to 100 Octane	6.1	100			2466
Normal Butane (Deficiency)				(134)	
Iso-Butane Surplus					436
Total "Net" Aviation Component Yield			670	1132	2902
Remaining C_4 — 410° Gasoline Components					
Iso-Butane			83		
Butene			215		
Normal Butane			188		
Iso-Pentane			78		
Pentenes			157		
Normal Pentane			157	232	156
C_6 — 410° Thermal Cracked Naphtha			3369	3369	1959
Heavy Alkylate			—	31	29
Total Remaining C_4 — 410° Components			4247	3632	2144
Fuel Oil Components — total			4616	4616	4296
Total "Net" C_3 Free Liquid Components			9533	9380	9342

lation and thermal cracking operations.

b. Conventional pre-war crude distillation and thermal cracking operations, augmented by pentane fractionation, butene-pentene alkylation and butane isomerization.

c. Conventional crude distillation and thermal operations modified as in (b) above, with catalytic gas oil cracking substituted for thermal gas oil cracking.

As previously stated, the yield figures of the flow diagrams have ignored secondary production quantities and losses in order to simplify the overall process comparison. Recognizing this point, reference to the table shows for a 10,000-bbl run of the particular crude chosen and particular processing operations used:

1. Addition of alkylation and isomerization operations to conventional pre-war crude distillation and thermal cracking operations doubles the aviation gasoline production, while raising the gasoline octane rating (AFD-1C+4 cc TEL) from 91 to 100.
2. In order to achieve this production, additional normal butane must be obtained from outside sources for isomerization plant feed.
3. Substituting two-pass catalytic cracking for recycle thermal gas oil cracking again doubles the aviation gasoline production.
4. With catalytic cracking, a surplus of 436 bbl of isobutane results as compared with a butane deficit of 134 bbl for thermal cracking.
5. Aviation base stock production from the catalytic cracking operation is of considerably higher quality than the virgin base stock.
6. In going from the conventional pre-war operation to full scale aviation gasoline production, components remaining for motor gasoline production are cut in half.
7. The percentage of C_4 and C_5 fractions available for motor gasoline blending drops from some 23% of the total motor gasoline components in the case of conventional pre-war operations, to some 7% for the case of large scale catalytic aviation gasoline production.
8. A marked increase in aviation gasoline production causes only a relatively small reduction in total distillate and residual fuel production.

It should be emphasized that the figures of Table 2 are illustrative only, and are in no way intended to present a completely balanced refining operation which would, of course, take into consideration secondary yields and losses, and account for properly treated and blended finished motor gasoline production. The schedule does show the general effect on availability and quality of other refining products of increased aviation gasoline production, and the importance of catalytic cracking in the war-time aviation gasoline program. Yields used are conservative. In many cases it would be possible to substantially increase the yield of 100 octane gasoline over that indicated by employing such additional operations as propylene alkylation, thermal re-cracking of catalytic cycle stock, pentane and hexane isomerization, etc.

TABLE 3 — Motor Gasoline Production Cracking of Light and Heavy Gas Oils by Two Different Catalytic Processes

	Heavy Gas Oil	Light Gas Oil
Feeds		
Gravity—°API	22.3	33.6
Aniline Point, °F.	171	135
ASTM 50% distn.—°F.	825	485
Sulfur—Wt. %	2.49	0.46
Yields		
Motor gasoline—Vol. %	46.0	46.4
Cracked gas oil—Vol. %	51.2	38.8
Excess Butanes—Vol. %	2.0	11.3
Dry Gas—Wt. %	5.6	7.0
Coke Prod.—Wt. %	3.4	4.0
Motor Gasoline Properties		
Gravity—°API	58.2	54.2
Reid V.P.—Lbs/sq. in.	10.0	9.5
Sulfur—Wt. %	0.246	0.08
Aniline No.—°F.	82	63
Acid Heat	186	32
Octane No.		
CFR-M Clear	77.9	82.6
CFR-M + 1.5cc T.E.L.	81.2	87.0
CFR-R Clear	91.3	92.7
CFR-R + 1.5cc T.E.L.	95.3	96.7
ASTM Motor Dist.		
Distillate + Loss %		
@ 158°F.	18.5	20
@ 212°F.	38.0	39
EP, °F.	401	410
Recovery—%	97.5	98
Cracked Gas Oil Properties		
Gravity, °API	22.7	29.0
ASTM 50% dist., °F.	605	481
Aniline Point, °F.	124	113

Catalytic Cracking for Motor Gasoline Production

In a review of this character, it should not be amiss to pause for a minute to look into the future.

One of the outstanding characteristics of catalytic cracking processes is their ability to produce high quality motor fuels from a wide variety of charging stocks. This is shown in Table 3, which presents the results of catalytically cracking two widely different gas oils by two different processes for the production of some 46% of motor gasoline. These data are not presented for comparative purposes but to illustrate process yields and qualities.

The clear CFR motor octanes of the two gasolines are 12 to 15 points higher than would be obtained by conventional thermal cracking of the same stocks, and the clear research ratings 14 to 18 points higher. Lead susceptibilities are also excellent.

Catalytic gasolines of this character have good stability, and normally need only caustic washing and the addition of an inhibitor for motor gasoline use. In cases of high sulfur feed stocks, a light acid treat may also be required.

Considerable quantities of olefins and isobutane are also produced, along with an excellent grade of gas oil.

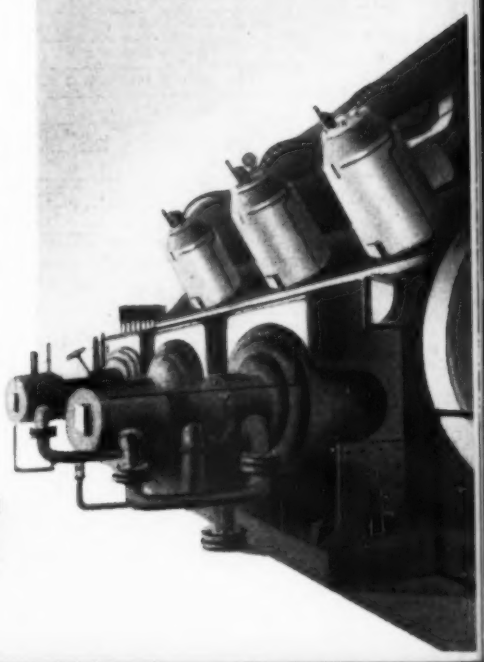
Many of the catalytic cracking units now on wartime aviation gasoline production will be converted to motor gasoline production in the postwar period. It is obvious that such conversion will play an important role in markedly increasing the overall quality of postwar motor fuels.

1953 *Business Runabout*

TURN the calendar forward. Picture yourself in your own backyard . . . taking off for the office a hundred miles away. Your streamlined helicopter rises, makes the run in an hour. It descends vertically, quickly, to your parking space. It solves the congested highway problem by soaring above it.

This transportation wonder is in production for the army. In post-war days it may be built of molded plywood and plastics. It will be driven by a powerful motor made largely of magnesium, smaller and lighter than today's auto engine . . . a diesel or one fueled by high octane gasoline.

Aviation gas, molded plywood, plastics, magnesium . . . all products of compression in which Cooper-Bessemer engines and compressors are playing such a vital part. These synthetic marvels are in practical use for war today. Tomorrow they will go into helicopters and a hundred other miracle products that are still inventors' dreams. And in their production . . . wherever gases must be handled . . . where economical power is needed . . . you will find dependable Cooper-Bessemer compressors and engines at work.



THE Cooper-Bessemer CORPORATION

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Effect of Aniline Point of Oil and Aromatic Content Of Gasoline on Behavior of Synthetic Rubbers*

The relationship is shown of the aniline point of oils and the aromatic content of fuels to the properties of synthetic rubbers in contact with these fluids, data which have not hitherto been published. Knowledge of the behavior of synthetic rubbers under these conditions is important in their consideration for replacements and substitutes for natural rubber in aircraft engines. It is also essential that the effect be known at the temperatures to be encountered in usage.

Neoprene and Buna S and Buna N are the classes of synthetic rubbers studied. Data shown are not to be considered as typical of the basic polymers, whose properties can be changed to meet required conditions, but as representative of stocks approved for this usage.

The complete paper outlines procedure in selecting a suitable synthetic rubber for aircraft engine applications, including the application analysis and laboratory testing. Only a portion of the paper is given here.

*By Gertrude H. Spremulli***

IN ANALYZING THE REQUIREMENTS of a particular synthetic rubber part for the aircraft engine the first consideration is whether resistance to any fluid, such as oil or gasoline, is necessary. It is, of course, well known that the various types of synthetic rubbers differ in the degree to which they are able to resist deterioration by such fluids. When considering the changes of synthetic rubber stocks in various fluids, it must be remembered that, in addition to the type of basic polymer used, the ingredients added during the compounding of the stock also influence the changes in properties. As one example of this, the work of Juve and Garvey (1)‡ on the compounding of Hycar OR stocks may be mentioned. They showed that certain softeners would cause increased swelling while others caused shrinkage and hardening due to loss of the softener by evaporation and extraction.

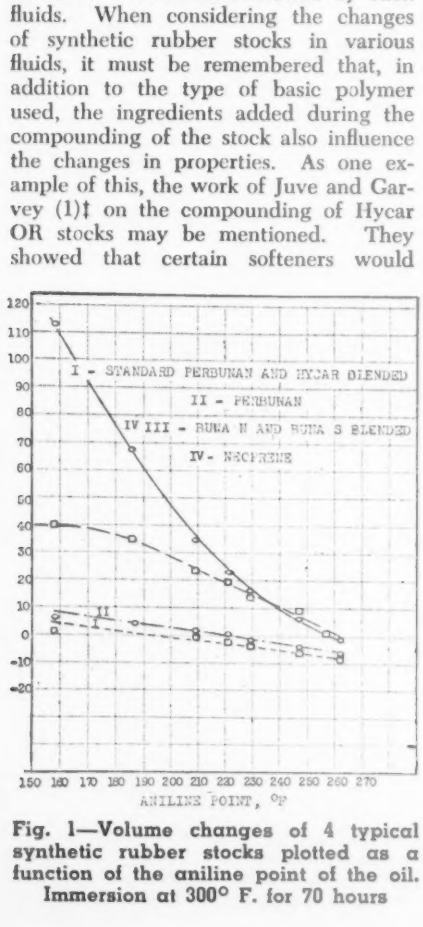

Fig. 1—Volume changes of 4 typical synthetic rubber stocks plotted as a function of the aniline point of the oil. Immersion at 300° F. for 70 hours

From the point of view of the users of the synthetic rubbers, therefore, it is more valuable to study the compounded stock as it is made available for use on the engine than to judge by the reactions of the basic polymers. The stocks listed in Table 1‡ illustrate the type of changes shown by synthetic rubbers in fluids such as might be encountered on the aircraft engine. These synthetic rubber vulcanizates are not to be considered as typical of the basic polymer, but rather as representative of stocks approved for various uses on Ranger engines.

The differences in fluid resistance shown in Table 1 by the various synthetic rubber stocks are greatly magnified when some of the variables affecting their changes in these liquids are considered. It was pointed out earlier that the oil resistance of these compounds is a function of the aniline point of the oil with which it comes in contact. The aniline point of the oil is defined as the critical solution temperature of a mixture of the oil and an equal volume of aniline. It is widely used as a measure of the aromatic content; however, it is affected not only by aromatics but, in a lesser degree, also by naphthenes and by the average molecular weight of all constituents, including the paraffins.

A number of workers have shown that the aniline point of an oil will indicate its probable swelling effect upon a synthetic rubber stock. Carman, Powers, and Robinson (2) found that, in general, the logarithm of the percentage volume changes of synthetic rubbers in mineral oil varied inversely with the aniline point. Fraser (3) worked with lubricating and hydraulic oils and concluded that the aniline point and the viscosity-gravity constant may be used as criteria of the swelling effect of the oils on Neoprene vulcanizates. Since the aircraft engine manufacturer cannot control all the oils which may be used in the engine in its various fields of service, he must anticipate and prepare for oils of varying aniline point and, if possible, choose a synthetic rubber which will be satisfactory even when used with the worst type of oil that might be encountered. This necessity for resistance to such a wide range of oils considerably reduces the number of suitable synthetic rubber stocks.

To illustrate the effect of aniline point variation upon the volume changes of typical stocks available for aircraft engine use, oils with aniline points varying from 158 to 262°F. were prepared by mixing varying proportions of an aircraft engine lubricating oil with Circo† light processing oil. Some of the physical constants of these oils are listed in Table 2. Samples of the various synthetic rubber stocks were immersed in these oils at 300°F. for 70 hours. The resulting volume changes are plotted as a function of the aniline point in Fig. 1.‡ Since the viscosities and viscosity indices of these oils are varying simultaneously with the aniline points, the volume changes could be plotted as functions of these variables also. The aniline point is probably the easiest and most rapid of these variables to determine and it does serve as means of predicting the effect an oil will have on a synthetic rubber stock.

It has been known for some time (4) that aircraft engines are being operated on aromatic fuel blends in certain localities. Fuel containing 20% by volume aromatics is common and an aromatic content as high as 40% is not considered improbable. The addition of aromatic constituents to gasoline has a marked effect upon the synthetic rubber parts which come in contact with that gasoline. To show the effect of varying the aromatic content upon the volume changes of typical synthetic rubber vulcanizates, a series of gasolines was prepared by adding 0, 8, 16, 24, 32, and 40% aromatics by volume to 65 octane gasoline. In all cases the aromatic components were benzene, xylene, and toluene in the following proportion: 1 : 3 : 4. The volume changes of typical stocks

†A commercial oil with a low aniline point.

‡Numbers of references to bibliography, tables, and charts do not correspond to those in the original paper.

*A portion of a paper entitled "Synthetic Rubber Applications on Aircraft Engines", presented before the annual meeting of the Society of Automotive Engineers, Detroit, Jan. 11, 1944.

**Ranger Aircraft Engines, Division of Fairchild Engine & Airplane Corp., Farmingdale, L. I.

immersed in these fuels for 24 hours at room temperature are plotted as a function of the percentage aromatics in Fig. 2. While the function is linear in all cases, the slopes vary with the type of synthetic used.

It is apparent from Figs. 1 and 2 that analyzing the requirement of fluid resistance involves consideration not only of present operating conditions but also an estimate of what might happen under the worst possible conditions.

Testing the oil resistance of a synthetic rubber stock for aircraft engine applications is done routinely by measuring the changes in volume, hardness, tensile strength, and elongation which take place during a 70-hour immersion of the sample in both aircraft engine lubricating oil and rubber processing oil at 300°F. It has already been shown that the volume change of the stock will be a function of the aniline point of the oil used. The aircraft engine lubricating oil and the Circo light processing oil represent extremes in aniline points and, therefore, are expected to represent limits of volume change to be exhibited by the synthetic rubber part.

The value of testing in the processing oil has often been questioned, since it has not been shown that oils with such a low aniline point will ever be encountered in service. This testing does, however, have three advantages: It fixes the upper limit for volume changes; it provides a type of accelerated aging test by which long-time service changes may be judged; and it presents a method of identifying the basic polymers used in the synthetic rubber stock, since the volume changes of the Buna N stocks are characteristically lower than those for the polychloroprene types. The temperature of 300°F. was chosen because it represents the upper limit of what is likely to be met in service by those parts required to be oil resistant.

An investigation of the effect of temperature upon the changes in typical synthetic rubber stocks when immersed in various oils was conducted to determine whether the routine testing procedures give an adequate picture of what may happen during the service life of a part which must be oil resistant. Various synthetic rubber compounds were aged in the oils described in Table 2 at room temperature, 100, 150, 212, 250, and 300°F. for 70 hours.

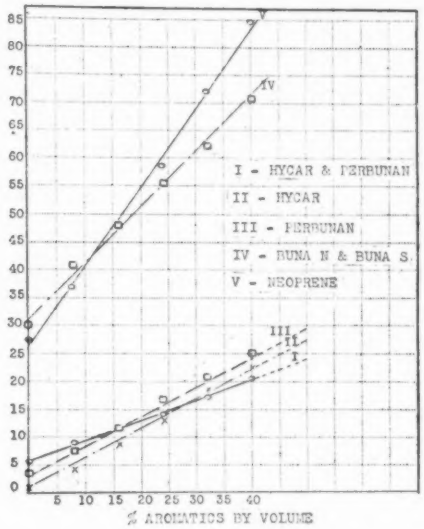

Fig. 2—Effect of increasing aromatic content on volume changes of synthetic rubber stocks in fuels. Immersion at room temperature for 24 hours

The effect of temperature upon the volume changes of these synthetic rubbers in the aircraft engine lubricating oil is shown in Fig. 3. It is at once apparent that no generalizations can be made regarding the effects of temperature, since they vary with the type of stock tested. It is significant to note that a stock which shows a positive volume change at 300°F. may shrink when tested at lower temperatures. Most oil seals require small positive changes in volume, and leakage may occur if the material shrinks appreciably. Therefore,

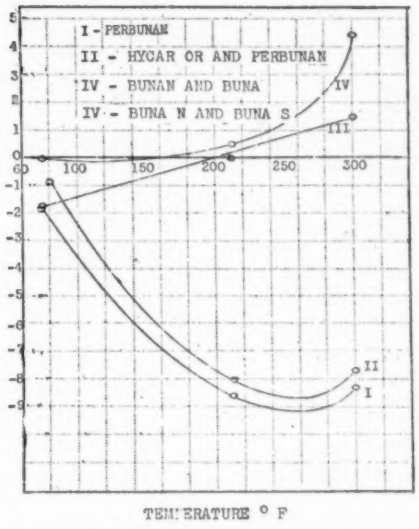

Fig. 3—Effect of temperature upon volume changes of synthetic rubber stocks aged 70 hours in aircraft engine lubricating oil

if the material for such a seal is selected on the basis of volume changes at 300°F., but in service the temperature of the oil encountered is much lower, the part might not perform satisfactorily.

To insure adequate sealing, then, either an accurate estimate of the service temperature must be made and the material checked at that temperature or a stock must be chosen which shows a satisfactory volume change over the entire temperature range. It can also be seen from Fig. 3 that for those stocks which showed negative volume changes in the aircraft engine lubricating oil, the temperature of maximum volume change was not at 300°F. If it is desired, therefore, to establish the limits of volume change in an oil, it may be necessary to use a testing temperature other than 300°F.

Fig. 4 illustrates the effect of temperature upon the changes in hardness occurring during 70 hours aging in the aircraft engine oil. All three stocks hardened during this oil immersion but the relative amounts of hardening was a function of the temperature. The temperature of maximum hardness change for all of them occurred between 200 and 250°F. rather than at 300°F. This suggests that for applications where the softness of the material affects the functional characteristics of the part, it might be more valuable to test at several ele-

Table 2—Physical Constants of Oils Prepared by Mixing Varying Amounts of Circo Light Processing Oil with Aircraft Engine Lubricating Oil

% Processing Oil by Volume	Aniline Point °F.	Viscosity at 100°F. (Secs.)	Viscosity at 210°F. (Secs.)	Viscosity Index
0	257	1707	121	97.1
20	247	1052	89	92.5
40	229	646	68	86.9
50	221	516	62	84.9
60	209	394	55	79.3
80	186	248	46	52.8
100	158	157	41	16.9

Table 1—Fluid Resistance of Various Types of Synthetic Rubber Stocks

Base Polymer	AIRCRAFT ENGINE OIL† Volume Change %	Hardness Change*	Tensile Strength Change %	Elongation Change %	65 OCTANE GASOLINE‡ Volume Change %	Hardness Change*	Tensile Strength Change %	Elongation Change %	ETHYLENE GLYCOL§ Volume Change %	Hardness Change*	Tensile Strength Change %	Elongation Change %
Neoprene	+ 1.5	+10	+24	—54	+22	— 1	—16	— 8	+21	— 4	— 9	—57
Hycar OR	—16	+30	+13	—56	+ 1	+ 8	—22	—19	— 6	+13	+13	—50
Perbunan	— 6.0	+ 7	+15	—40	+ 5	0	+10	—17	— 7	+ 3	+33	—17
Perbunan + Hycar	— 9.0	+19	+35	—62	+ 3	— 5	—19	—25	— 3	+12	+33	—63
Buna N / Buna NXM / Buna S	+ 0.3	+ 5	— 7	—44	+23	— 9	—49	—36	+ 7.5	+ 5	—18	—43

† 70 hours at 300° F.
‡ One week at room temperature
§ 70 hours at 300° F.
* In Shore Durometer "A" units

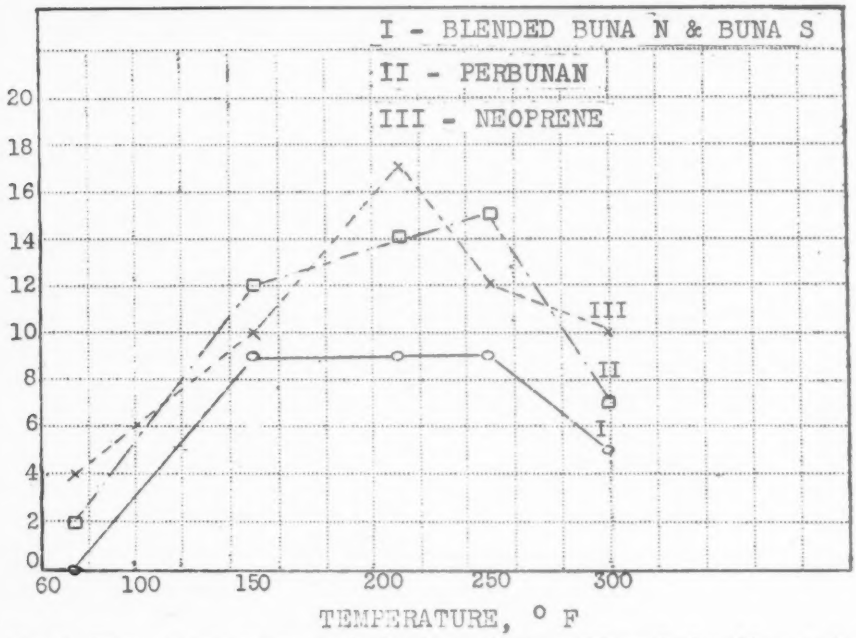

Fig. 4—Effect of temperature on the hardness changes of 3 synthetic rubber stocks at the end of 70 hours immersion in aircraft engine lubricating oil

vated temperatures and at a temperature as close to the actual service conditions as possible.

The effect of temperature upon the changes in tensile strength and ultimate elongation occurring during aircraft engine lubricating oil aging for 70 hours is illustrated in Figs. 5 and 6. It is evident from these figures that testing at 300°F. may not reveal the maximum changes that occur in these properties as a result of oil aging. Not only does the temperature influence these changes, but the manner of its effect varies with the stock tested, so that the comparative values of the stocks are a function of the temperature of testing.

Fig. 7 shows the effect of temperature upon the volume changes of typical synthetic rubber stocks when immersed in Circo light processing oil for 70 hours. These curves also illustrate that testing at 300°F. may not reveal the maximum in the changes occurring. The comparative values of the stocks remain the same, however, regardless of the temperature of testing.

It must be emphasized that in all these studies of the effect of temperature upon the property changes occurring during oil aging, the determinations were made at the end of 70 hours. This immersion period was chosen because it is the one used routinely when testing for conformance to the Aeronautical Material Specifications. If, however, these changes have not reached equilibrium at the end of the 70-hour period, then the conclusions drawn might have to be revised according to the immersion period chosen for the testing.

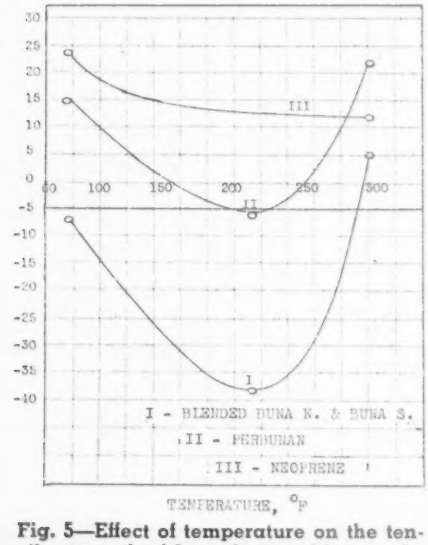

Fig. 5—Effect of temperature on the tensile strength of 3 synthetic rubber stocks after 70 hours immersion in aircraft engine lubricating oil

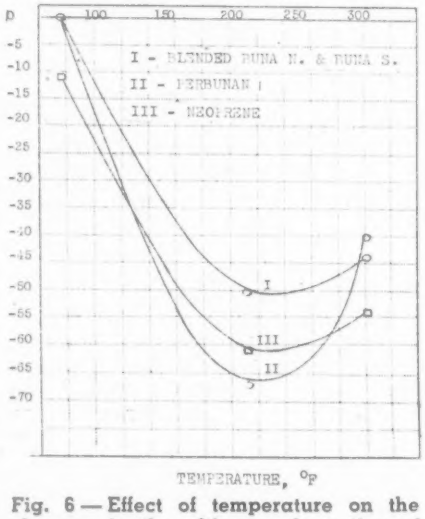

Fig. 6 — Effect of temperature on the changes in the ultimate elongation of 3 synthetic rubber stocks at the end of 70 hours immersion in aircraft engine lubricating oil

The influence of temperature on the variation of volume change with the aniline point of the oil was studied for four of the stocks. Except for the Neoprene stock, the temperature of testing changes the type of functional relation between the volume change and aniline point entirely. The slopes of the curves at the higher temperatures are generally steeper, indicating that the aniline point has a greater significance as far as volume changes are concerned at the higher temperatures. The accelerating effect of temperature upon the functional relationship is illustrated also in the curves relating hardness changes to aniline points of the oils.

The tests included in the Aeronautical Material Specifications for checking synthetic rubber stocks for resistance to aromatic fuels involve determining the changes in volume, hardness, tensile strength, and ultimate elongation after 24 and 168 hours immersion in 40% blended aromatic fuel. Tests in 65 octane gasoline are made at the end of 24 hours to insure that the compounds do not shrink in this fuel. The amount of gum extractable from the synthetic rubbers by aromatic fuel, as well as the fuel-insoluble residue, is also determined. These tests are all conducted at room temperature.

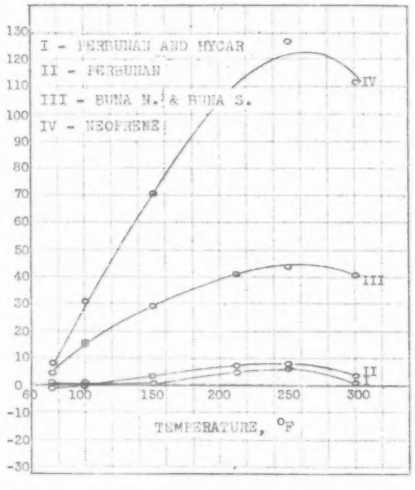

Fig. 7—Effect of temperature on volume changes of 4 synthetic rubber stocks aged 70 hours in rubber processing oil

The effect of varying the aromatic content of gasoline upon the volume change of typical synthetic rubber stocks has already been shown (See Fig. 2). The relationship was found to be linear for all the stocks tested. Changes in other physical properties, however, are not as simply related to the aromatic content. After a week's immersion the compounds tested showed changes in tensile strength which varied in a more complicated manner with increasing percentage of aromatic constituents in the fuel. This is illustrated in Fig. 8, from which it is also evident that the type of function varies with the material tested.

Daily determinations of the volume changes of five different synthetic rubber compounds immersed at room temperature in fuels varying from 0 to 40% in concentration of aromatic compounds were made. With the exception of the Neoprene stock, which would

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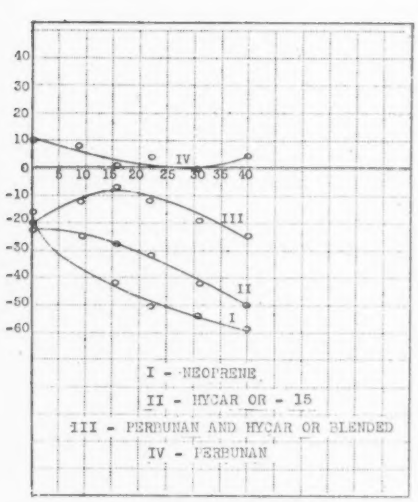


Fig. 8—Effect of percentage aromatics on tensile strength changes of synthetic rubbers in fuels at the end of one week's immersion at room temperature

not be used for applications requiring an aromatic fuel resistant material, it is evident from these curves that when testing in the 40% aromatic fuel, the specified 24- and 168-hour periods will give an adequate picture of the extremes of volume changes likely to occur, since the maximum in the curves occurs at the end of 24 hours. In some of the fuels with lower concentrations of aromatics, however, the maximum volume change is often not reached before the end of 48 hours.

Again excepting Neoprene, it appears that increasing the concentration of aromatic components hastens the time at which the maximum volume change will occur. For those stocks studied, checking the volume change in 65-octane gasoline at the end of 24 hours was an adequate guarantee against shrinkage. Since it is noted, however, that the volume change has in all cases decreased at the end of 168 hours, it appears that stocks which swell only slightly during the first 24 hours should be checked again at the end of a week to insure that no shrinkage has occurred.

The effect of increasing the temperature of gasoline aging was studied for two stocks in both the 65-octane gasoline and in 40% aromatic blended fuel. Measurements of changes in volume, tensile strength, and ultimate elongation were made at the end of 24 and 168 hours. The effect of subjecting these stocks to only the vapors of these two fuels was also checked. The results of these studies are summarized in Tables 3 and 4. It is evident from these tables that temperature has no great nor consistent effect upon the changes occurring in the stocks during the gasoline aging. It may also be concluded that the routine checking at room temperature will give a sufficiently accurate picture of the performance of those parts which may encounter gasoline at higher temperatures during service.

The adequacy of the 48-hour extraction period at room temperature for indicating the amount of gum extractable from a synthetic rubber stock by the aromatic (40%) fuel was checked by increasing both the time and temperature of extraction. For the extractions at room temperature, the method as described in the Aeronautical Material Specifications was followed except that determinations were made both at the end of 48 hours and at the end of a week. After the extraction periods (48 and 168 hours) the remainder of the procedure followed that described in the specification. The results of the extraction tests are summarized in Table 5. It is apparent from this table that at constant temperature the length of time of extraction has a relatively small effect. The temperature at which the extraction is carried out however, may be an important factor in determining the amount of gum extracted. Neither variable causes sufficiently great difference in the amount of fuel-insoluble residue to make that quantity significant.

The difference between the relative effects of temperature upon the amounts of gum extractable from the two stocks tested may be explained, in part at least, by the fact that different plasticizers were used in the two cases. The solubility of the one plasticizer in aromatic fuel is obviously a more critical function of temperature than is the solubility of the other. It may be concluded from the data in Table 5 that a 48-hour extraction period at room temperature does not necessarily reveal the amount of gum extractable, if gasoline at elevated temperatures is encountered.

Spectrographic analysis of the extracted material confirmed its essentially organic nature. A slight trace of zinc was also detected. Because of its organic nature, it is not expected that the gum will have harmful effects upon the performance of the fuel, if the quantities are kept relatively small.

Table 3—Effect of Temperature Upon the Changes in Physical Properties of Synthetic Rubber Stocks When Immersed in 40% Aromatic Fuel

	40% AROMATIC FUEL AGING							
	24 HOURS				168 HOURS			
	Volume Change %	Hardness Change*	Tensile Strength Change %	Elongation Change %	Volume Change %	Hardness Change*	Tensile Strength Change %	Elongation Change %
Neoprene:								
Room Temperature	+84.5	—19	—61	—54	+88	—16	—60	—46
115° F.	+77.4	—16	—61	—54	+78.4	— 8	—59	—54
140° F.	+74	—11	—57	—46	+86	—11	—68	—46
Vapor	+80							
Perbunan:								
Room Temperature	+24.7	—22	— 1	—17	+23.5	—10	+ 3.5	—33
115° F.	+21.3	—18	—18	—17	+22.6	—10	— 8	—33
140° F.	+24.3	—17	— 8	0	+27.9	—25	—32	—17
Vapor	+18.8							

* In Shore Durometer "A" Units.

Table 4—Effect of Temperature Upon the Changes in Physical Properties of Synthetic Rubber Stocks When Immersed in 65 Octane Gasoline

	65 OCTANE GASOLINE AGING							
	24 HOURS				168 HOURS			
	Volume Change %	Hardness Change*	Tensile Strength Change %	Elongation Change %	Volume Change %	Hardness Change*	Tensile Strength Change %	Elongation Change %
Neoprene:								
Room Temperature	+27.5	—10	—18	—23	+22.2	— 1	—16	— 8
115° F.	+22.9	— 8	—24	—17	+22.0	0	—45	—24
140° F.	+24.1	— 2	—29	—17	+23.8	— 4	—28.5	—23
Vapor	+23.5							
Perbunan:								
Room Temperature	+3.4	—11	— 1	0	+4.9	0	+10	—17
115° F.	+2.8	— 5	— 7	0	+1.4	+ 1	+ 5	—17
140° F.	+6.0	— 4	+ 3	0	+4.9	—11	— 1	0
Vapor	+9.4							

* In Shore Durometer "A" Units.

Table 5—Effect of Time and Temperature Upon the Aromatic Fuel Extract of Synthetic Rubber Stocks

Stock	48 HOURS		168 HOURS	
	Gum Content, %	Fuel-Insoluble Residue %	Gum Content, %	Fuel-Insoluble Residue, %
	AT ROOM TEMPERATURE			
Neoprene	8.1	.03	8.15	.03
Perbunan	3.0	.035	3.4	.07
	AT ELEVATED TEMPERATURES			
Neoprene	8.7	.03	9.2	.03
Perbunan	6.4	.04	6.46	.15

Abridged Bibliography

(1) Juve, A. E., and Garvey, B. S., Jr. Vol. Change of Hycar OR-15 Compounds on Immersion. Ind. and Eng. Chem. 34: 1316. 1942.

(2) Carman, F. H., Powers, P. O., and Robinson, H. A. Swelling of Synthetic Rubbers in Mineral Oils. Ind. and Eng. Chem. 32: 1069-1072. 1940.

(3) Fraser, D. F. Effect of Lub. & Hydraulic Oils. Rubber Chem. and Tech. 14:204. 1941.

(4) War Dept., Air Corps, Mat. Div. Memo. Report No. Exp. M-57-531-112. Aromatic Fuel Blends in Tactical Aircraft. Dec., 1941.

Key Technologists in New Wartime Plants

Putting on stream the new refinery units making aviation gasoline, synthetic rubber chemicals and other essential petroleum products has brought added responsibilities to the technical staffs of the oil companies operating the plants. In some cases the supervision of the new units has been placed with the present department heads of the refinery. Entirely separate supervisory heads have been set up for some of the plants. In many cases the men now in charge of operations of the plants also had a hand in their design and construction and in the integrating of operations of the older units to provide the maximum output of wartime products from the refinery.

The construction and starting of operations of the wartime plants has been an accomplishment in which the entire industry has taken great pride. To introduce some of the technologists who have had an important part in the individual companies' programs, NPN's Technical Section will carry brief biographical sketches of the supervisory staffs of the new units. Those for two companies are introduced below; others will appear in later issues.

Atlantic Refining Co. Aviation Gasoline Plant

Charles A. Pines

THE PRODUCTION of 100-octane aviation gasoline at the Point Breeze refinery of The Atlantic Refining Co. is under the direction of Charles A. Pines, assistant superintendent of the refinery department, in charge of cracking operations. Born in Brooklyn in 1893, he received his technical education at New York University, graduating in mechanical engineering in 1916.

He enlisted in the Naval Air Service and had just about completed his training course when World War 1 ended. He then went to work for Atlantic Refining as supervisor of steam generation and distribution. In 1925 he left the position of assistant superintendent of the power department to enter refinery operations.

Associated with Mr. Pines and charged with the responsibility of co-ordinating the operations of closely integrated units for maximum output of 100-octane gasoline is William T. Smith. Educated in Philadelphia schools, he studied chemical engineering in Lehigh University and received his B.S. in chemistry from Temple University in 1915. He worked first for Philadelphia industrial plants and became associated with Atlantic Refining as a chemical engineer in 1922. He left the chemical engineering laboratory to become a special engineer in the refinery department, was successively general foreman of the coke and rerun stills and of the naphtha and light oil finishing division. He was transferred to the cracking division in 1929 and subsequently became operating assistant.

The field development work for the 100-octane aviation gasoline program of The Atlantic Refining Co. at this plant has been largely in the hands of Anthony E. Hassler, chief process engineer for the refinery department. He has been active in the conversion of a catalytic polymerization unit to manufacture codimer and in the conversion, starting-up and operation of a thermal polymerization unit and other equipment to become one of the largest producers of cumene in the oil industry.

Mr. Hassler was born in Reading, Pa., in 1902 and received his B.S. in chemical engineering from Pennsylvania State College in 1925. He joined The Atlantic Refining Co. in 1926, his first job being as a shift operator in the initial battery of Cross units. He spent a year in the research and development department as a junior engineer. From there he was successively a foreman in the naphtha treating division, then in the cracking division, was a special engineer in the cracking division from 1937 to 1943 and since then has been chief process engineer.

In the hands of these men and their associates will be the operation of one of The Atlantic Refining Co.'s fluid catalyst cracking units, construction of which is nearly completed, stated H. M. Nichols, manager of the refinery.

Cities Service Oil Co. Aviation Gasoline Plant

Roy V. McGrath

THE AVIATION GASOLINE unit of Cities Service Oil Co. at East Chicago has been in operation since May, 1943, and has been under the supervision of John D. Snakenberg, refinery superintendent; John A. Witherspoon, light oil superintendent; and Roy V. McGrath, aviation plant foreman, according to Lee Haugen, plant manager.

Mr. Snakenberg, after receiving a degree in civil engineering from Iowa State College, joined Cities Service Oil Co. in 1923. He saw service at Oklahoma and Texas refineries of the company before coming to the East Chicago plant to start the pressure stills in 1930. He has served here as pressure still foreman, assistant superintendent and refinery superintendent.

Mr. Witherspoon worked during several summer vacations at the refinery in Texas before receiving a degree in chemical engineering from Texas A. & M. College. After starting in engineering and research work at the Texas plant he was transferred to the East Chicago refinery in 1937 to assume the duties of gasoline recovery plant foreman.

At East Chicago he has worked on technical problems, plant design and aviation gasoline production.

Mr. McGrath came to Cities Service Oil Co. from Wm. Jewell College in 1926 and started in the research laboratory in Oklahoma. He went to the East Chicago refinery in 1934 to serve as resident chemist. At present he is in charge of the aviation gasoline plant.

Mobilized Research*

Wartime Test Work Provides a Preview of the Post-War Automotive Petroleum Products

The unusual conditions which the standard types of automotive fuels and lubricants have been called upon to withstand in military service, and the entirely new usages to which petroleum products have been adapted to meet wartime needs, are shown in an outline of the test and research work being carried on by the Co-ordinating Research Council, Inc. The tests are also indicative of the wide and varied requirements which automotive petroleum products will be called upon to meet after the war.

The Co-ordinating Research Council, sponsored by the Society of Automotive Engineers and the American Petroleum Institute, is a body of 12 technologists which directs the activities of some 150 technical groups in the solution of problems of fuels, lubricants and equipment common to both the automotive and petroleum industries. All its test work at present is concentrated on wartime projects.

In the accompanying article there is omitted the portions of the original paper describing the scope of the C.R.C. (See NPN's Technical Section, March 3, 1943, p. R-136) and outlining its future activities.

By C. B. Veal**

Lubricants

THIS global war requires two kinds of endurance; resistance to long periods of strenuous usage and to extremes of climate. An ambitious prewar motorist, of the present A-card holder class, required from his car routine individual workday transportation with a few weeks of intensive vacation use; during which he might successfully nurse his car through several days of hot arid weather to see the wonders of our great Southwest, or with suitable precautions, make his way through the high altitudes and cold temperatures of our Rocky Mountains.

The same car owner, inducted into the service, depends for his safety and the success of his military mission on long periods of unfailing, strenuous performance. We must have in the desert a gasoline that will not vapor lock, a lubricant that will not break down; in Iceland and Alaska, a fuel that will start an engine at sub-zero temperatures and a grease that will permit his gears to turn.

War is a photographic enlargement; it reveals in stark crudity imperfections that are overlooked in peacetime scrutiny. The Council's mission is to anticipate and remedy in advance such imperfections.

To instance, one of the groups working under our Lubricants Research Committee collects and analyzes service information on military land vehicles for coordination with data obtained in the several laboratory test projects on motor oils. An investigation is also under way on the effect of oil additives on bearing surfaces operating under local or general high oil temperatures. Laboratory tests are being carried out and field data collected, to determine whether actual failures have occurred in service.

Field tests of representative types of heavy-duty engine oils are being conducted in military land vehicles at Camp Seeley, Cal. Members of our technical civilian Army have worked through the scorching desert heat to help provide their brothers-in-arms with oils that will serve unfailingly in similar climatic conditions in Africa or southern Italy. Similar important fuel research will be referred to later.

Gear Lubricants

Dropping to the lower end of the thermometer, lubricant research is concerned with developing test conditions that will adequately predict the performance of oils under low temperatures, both in starting and under longer conditions of service. Another project in this class is the development of information on the cold starting characteristics of gear oils and the loss of diluent in operation. Laboratory inspections and analyses have been made on 289 samples of gear oil returned from the field. Cold room tests are being made on representative lubricants.

Data on military cold weather testing of gear oils have been made available to the group for analysis and comment. Fifteen laboratories are participating in the development of a satisfactory method for determining the low-temperature characteristics of greases. A final project of the Coordinating Lubricants Research Committee dealing with temperature effects was a review of literature on the effect of temperature on the volume of hydraulic fluids.

Information peculiarly of interest in this war concerns the water resistance and water compatibility of greases used in amphibious equipment. This is a subject of study.

Reflecting the need for special provision to meet severe operating conditions is a project carried out by the Coordinating Lubricants and the Coordinating Equipment Research Committees.

In developing requirements to ensure satisfactory extreme pressure gear lubricants for Army ground vehicles, a dearth of performance data and inadequacies in test methods were revealed. To fill this lack, comprehensive field and laboratory tests of typical lubricants are being carried out. Field tests with Army equipment at both Aberdeen Proving Ground and Camp Seeley include high torque, high speed and endurance runs.

Further, to assist the Armed Services in meeting weather operating hazards, the Coordinating Equipment Research Committee has organized a group to accumulate available information and experience on the problems of cold weather operation sludge and its prevention. Another group has provided technical direction and observation for tests of Army ground vehicle tests in Tioga Pass designed to throw light on the relation of load to performance at altitude.

Fuels

Turning to the Coordinating Fuel Research Committee, a continuing volume of research has been devoted to knock characteristics. The improvement of knock test instrumentation has been carried out during the war emergency to meet the need for more accurate and expeditious rating of fuels. Corrected guide tables also have been prepared, specifically for knock ratings at high altitude. A comprehensive study has been conducted of spark advance, speed and detonation relationships in liquid and air-cooled engines in military ground equipment. This is directed not to audible detonation, but to the effects of borderline detonation on the engine's mechanical structure and maintenance. Extensive testing in co-operation with the

*A portion of a paper under this title presented before the annual meeting of the Society of Automotive Engineers, Detroit, Jan. 14, 1944.

**Manager and Secretary, Co-ordinating Research Council, Inc.

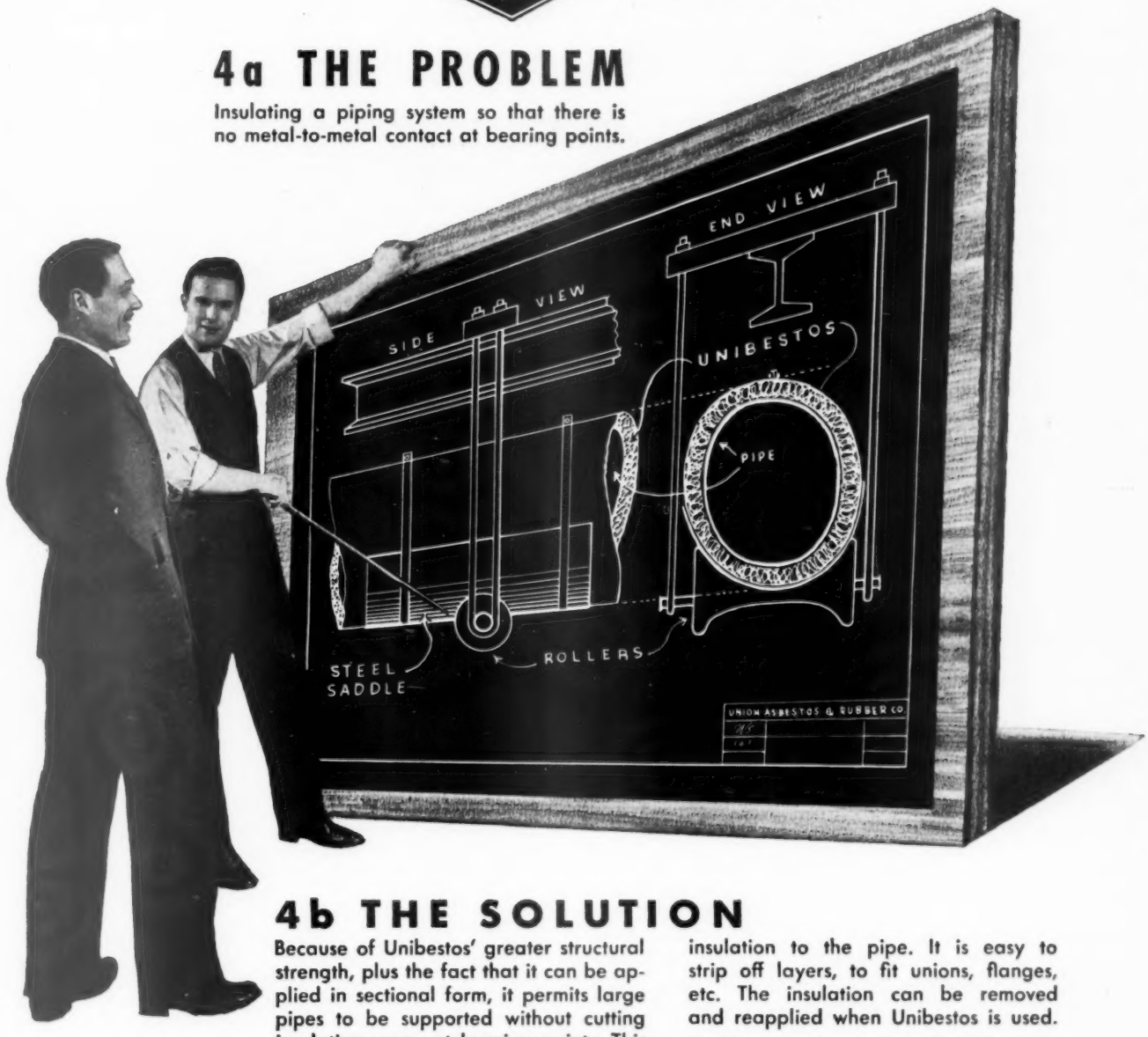
This is the 4TH in a series of messages

DEALING WITH THE PROBLEMS IN HEAT INSULATION FACED BY ENGINEERS AND SOLVED BY USING

UNARCO unibestos

4a THE PROBLEM

Insulating a piping system so that there is no metal-to-metal contact at bearing points.



4b THE SOLUTION

Because of Unibestos' greater structural strength, plus the fact that it can be applied in sectional form, it permits large pipes to be supported without cutting insulation away at bearing points. This is done by laying a steel saddle under the insulation at points where the pipe is supported by rollers, tie rods or other means. This makes it unnecessary to cut away the insulation or to use metal supports that penetrate through the insulation to the pipe. It is easy to strip off layers, to fit unions, flanges, etc. The insulation can be removed and reapplied when Unibestos is used.

unibestos is available in Standard material, for temperatures up to 750°; Super, with a temperature limit of 1200°; Combination, with a temperature limit of 1200°. These temperature limits permit the use of one material at maximum efficiency for a wide range of purposes. Unibestos is available in half sections up to 30" pipe diameter and from 32" to 60" in quadrants from ¾" to 5" in thickness. Standard and Super are available in single layer construction with provision for expansion in piping, where required.

ARMY-NAVY "E" AWARDS

TWO ARMY-NAVY "E" AWARDS FOR EXCELLENCE IN WAR PRODUCTION ONE TO THE CICERO, ILLINOIS PLANT, ONE TO THE PATERSON, N. J. PLANT

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equipment manufacturers has been involved, as well as full consideration of fuel availability.

The vapor-locking tendency of present and proposed military ground vehicles must be adequately investigated to forestall this difficulty in service. CRC has cooperated with Ordnance Department representatives in the planning and conduct of tests at Camp Seeley which started in July and are now completed. Another group is making an intensive study of all available data with a view to developing refinements in technique for correlating distillation characteristics of fuels with vapor lock and vapor handling capacity.

Turning again to low temperature problems, to assist in establishing cold starting requirements to be met by a single Universal Motor Fuel for Army ground vehicles, a procedure was evolved for testing the starting and warming-up characteristics of motor fuels. The effect of fuel volatility on engine starting also was investigated in tests on 12 medium tanks employing 5 test fuels. In addition to the main objective, the effect on starting of throttle position, booster coil, and various priming factors was also determined.

Vapor Locking Studied

Knocking and vapor-locking characteristics have also occupied a large part of the attention of the CFR Aviation Fuels Division. The Multi-Cylinder Engine and Analysis Groups provide an analysis and interpretation of full-scale aircraft engine detonation results on current military fuels under military operating conditions. A wide range of aviation fuels of military interest have also been tested in a group of laboratories. A number of test methods and engine variables have been investigated to improve the reproducibility of a laboratory method of test giving results in agreement with those of the Full-Scale Analysis Group.

Among the vapor lock projects has been a survey of aviation gasoline characteristics as related to vapor lock, with data on 30 commercial aviation gasolines. A study has been made of changes taking place in fuels during flight under a variety of conditions and their effects on the occurrence of vapor lock. In the laboratories of the National Bureau of Standards, the Aviation Fuels Division has worked with the Army Air Forces in determining fuel evaporation loss during high altitude flights and in studying the control of such losses both through engine design and suitable gasoline characteristics.

Co-operating also with the Navy Bureau of Aeronautics, the Aviation Fuels Division has studied at the Bureau of Standards optimum fuel line size, heat transfer through fuel tank walls, and fuel pump efficiency. Aircraft manufacturers have assisted in tests on the vapor handling capacity of carburetors. Arrangements have also been completed to investigate the extent of evaporation losses occurring during extensive long-range flight tests.

The effects of varying fuel volatility on the performance of aircraft engines have been of primary importance to the military, engine builders, fuel suppliers and commercial aircraft operators for some time. Tests to obtain qualitative and quantitative data have been under way for the last several years, and a re-analysis of the tremendous amount of flight test data thus made available has been completed. This has constituted an accurate appraisal of the limitations of present information and the further work required to cover the lower temperature range of military operation. In co-operation with the Army Air Forces, flight studies of the effect of fuel volatility on engine performance have also been made over a wide range of carburetor air temperatures.

Coolant Materials

Cooling problems for liquid-cooled aircraft engines have assumed increasing importance with the more stringent requirements of military usage, and all phases have been studied. Fifteen potential coolant system design projects are under consideration. The physical properties of ethylene glycol, and their change with use, its corrosive effects, and the effects on engine performance of concentration of it in water mixtures, coolant temperatures and flow rate are being investigated. Still another group is considering the desirable characteristics and sources for new coolant materials.

Turning to automotive Diesel fuels, CRC groups have been assisting the Ordnance Department in establishing the requirements of a Single Universal Diesel Fuel, since such a fuel is desirable to simplify the supply problem in combat areas. An important item supplementing this assignment was the establishment of the minimum octane number requirements of Diesel-powered military equipment, and both laboratory and field tests have been carried out on this subject. Cold weather, mountainous operation has been studied in Tioga Pass, and hot, dry climate requirements, at Camp Seeley.

Experience having indicated that a combination of high altitude and low temperature represents the most critical operating condition for Diesel engines, using fuel of low cetane number, a program of cold room tests in which throttled intake is used to simulate altitude is being carried out. Starting tests are being carried down to extremely low temperatures. Information has also been developed on the relative value of various organic compounds which may be used as starting aids.

Shipment and Storage

In the second class of problems having special angles peculiar to war time usage of automotive vehicles, storage and shipment are involved. In peace, the time of shipment, the duration and place of storage may be selected to afford the most favorable conditions. In war, not only are these handling phases governed by necessity, they can neither be predicted, nor provided for properly.

One storage problem placed before the Co-ordinating Lubricants Research Committee required obtaining technical data as a basis for a pour point requirement for S.A.E. Grade 10 oils which will provide maximum fluidity at low temperature and eliminate the development in oils, in storage or standing in engine crankcase at fluctuating temperatures, of pour points higher than obtained on these oils by the A.S.T.M. procedure. Storage experience at extremely low temperatures was found meager. Procedure for reliably predicting pour point stability has been formulated.

A major consideration in storage is rust prevention. The Lubricants Committee was called upon to work out, for the Ordnance Department, requirements for rust preventive oil which should protect automotive gasoline or Diesel engines during storage and shipment, and permit, without damage to the engine, such limited operation as may be required during shipment and storage. By investigation, the necessity of special treatment for stored engines was established, a procedure for the application of rust preventive oil was developed and field-tested. The performance of a rust preventive oil from the operating rather than the rust preventing standpoint is being studied, and laboratory tests for rust preventives are being developed. A rust preventive oil for civilian vehicles, which does not require critical materials, has also been recommended.

Storage Problems

Storage problems of complete vehicles have been considered. The S.A.E. Committee on Storage of Motor Vehicles, in formulating a recommendation to the Office of Defense Transportation on corrosion prevention in stored vehicles, requested assistance with regard to the lubrication of transmissions. A report was submitted to the S.A.E. Committee, and as an outgrowth, suggestions were offered for precautions to be taken with regard to gear oils for Army vehicles during storage.

Recommendations have been made, on the basis of available information, for rust inhibiting greases for stored vehicles. Suitable methods for determining storage stability of lubricating greases are also being investigated. A further contribution to the S.A.E. Committee was an outline of good practice in preparing hydraulic brakes for storage and return to service. Similar recommendations

Perfection BY DIFFRACTION

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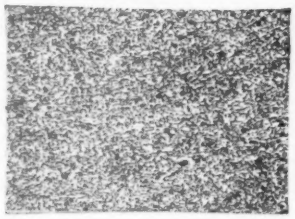

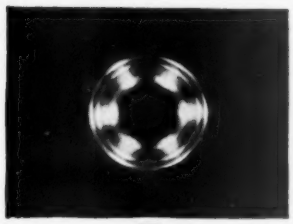

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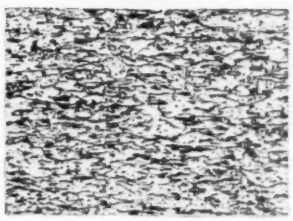

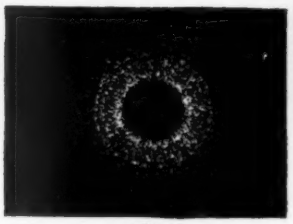

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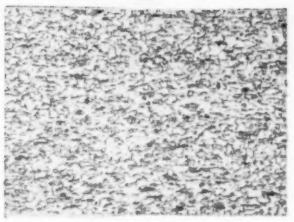

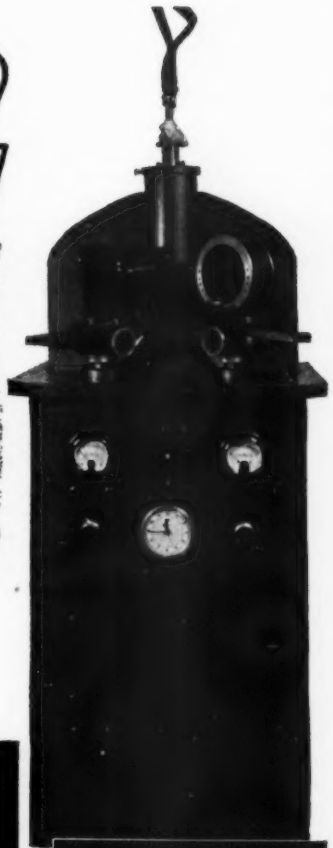

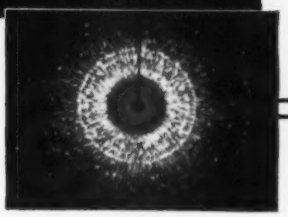

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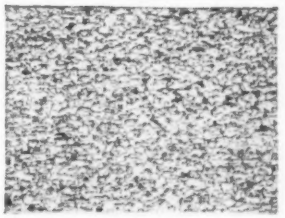

To make certain that your tubes will be as nearly perfect as it is possible to make them, B&W maintains a complete laboratory, with a dual staff of metallurgists: one to control production and the other to conduct research and aid you in your selection and use of tubing.

One valuable tool in this work is the method of X-Ray diffraction analysis shown here, which supplements the metallurgical microscope for studies of metallic phases, grain size, preferred orientation and state of strain, as related to properties and utilization of tubular products.

B&W engineers are always ready to help you with your problems and aid you in your selections from the complete line of B&W Tubing: Seamless, in a wide range of carbon and alloy steels in sizes from 1/2 in. to 8 5/8 in. O. D., and Electric Resistance Welded in carbon grades, from 3/4 in. to 4 in., O. D.

The illustrations above show X-Ray diffraction patterns (Laue) of low carbon steel tubing, with corresponding metallic structures for (A) hot-finished, (B) cold-drawn, (C) soft-annealed, and (D) annealed and straightened. It will be noted that the uniformly fine-grained annealed tube exhibits slight strain following the straightening operation. This is not evident in the microstructure but is readily detected by the diffraction method.

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were submitted for military vehicles.

A study of the stability requirements of motor fuel during shipment and storage was requested by the Ordnance Department. The group organized for this undertaking has met approximately once each month, and 5 working panels have been required to secure the necessary data. Temperature likely to be encountered in shipment and storage, the effects of containers and coatings, laboratory methods of predicting storage stability, and anti-oxidant effects on storage life were some of the topics studied. Storage tests under desert conditions are in progress at Camp Seeley, on the 435 samples required to cover the full range of fuels and conditions of storage. Simultaneously, accelerated storage tests are being carried out in laboratories on samples of the fuels stored in the desert.

The Automotive Diesel Fuels Division has been working on the development of a run-out fuel which will give maximum protection against corrosion and deposits in lines, pumps and injector equipment. A tentative set of requirements was drafted; tests to check these requirements are nearing completion. A volunteer group has carried out oxidation stability and corrosion tests on 4 fuels especially selected for this program. Injector parts have been placed in storage in fuels meeting the proposed requirements to check the corrosion and gum or lacquer formation under simulated field conditions. The limitations on a suitable flushing oil to be used in Diesel engine injectors in boxed vehicles and spare engines will also be recommended.

Substitute Materials

A third class of problem made acute by war instigates the search for substitutes for critical materials limited in supply. The necessity for using a minimum amount of critical chemicals and heavy oil stocks enforced revised procedure for qualification of engine oils. Accordingly, at the request of the Ordnance Department, 5 separate procedures were formulated. Another project had for objective conservation of oil additives and the development of new sources for heavy-duty oils to release materials needed for aviation lubricants. For this engine tests were made on 8 S.A.E. 50 oils, 6 types of detergent oils and two straight mineral oils. The detergent type oils contained 2/3 the amount of additive carried in the S.A.E. 30 grade of each particular oil. Seventeen laboratories participated.

The substitution of ferrous for nonferrous metals in Ordnance equipment is causing certain lubrication difficulties, which a Coordinating Lubricants Research Committee group is considering.

Two reports have been submitted on problems caused by the substitution of fatty acids for fats in cup greases, the replacement of fats having become necessary to meet the volume demand. Developing satisfactory substitutes for castor oil, which must be conserved, is a joint undertaking of the CLR Hydraulic Fluids Groups and representatives of the shock absorber and hydraulic brake manufacturers organized under the Coordinating Equipment Research. The latter are particularly interested since corrosion and the effect on rubber connections and fittings are involved.

Wartime Simplification

Simplification and standardization, and the extent to which these may be carried without deleterious effect on equipment or performance constitute the fourth type of war problem. A summary of grease specifications and lubrication instructions now in use is being made, as a first step toward a reduction of the number of the greases required by the Air Forces and aircraft operators under various climatic conditions. A complete summary and analysis of current government grease specifications has been prepared in response to a request from the Military Services which, at the suggestion of the Working Committee of the Aeronautical Board, are cooperating with the CLR Grease Advisory Group in attempting to simplify the requirements. A group is endeavoring to simplify shock absorber fluid requirements. A review of available data on the numerous hydraulic jack fluids employed by 15 manufacturers of hydraulic jacks supplied to the military forces clearly indicated that, with one exception, the jacks could be operated satisfactorily on one grade of mineral oil.

Technical Education

A fifth type of problem made urgent by war is the necessity of speeding up and spreading technical education. Because of the vastness of the engineering job to be done, a large number of novices must be introduced into fields, new to them, of operation, maintenance and testing. Partaking of the nature both of standardization and education continued and concentrated attention has been given during the last year to the test procedures formulated by the CRC. These methods have been carefully revised both technically and editorially. They have been amplified, clarified, and, as far as possible, brought to a standardized form.

There are 24 such test methods, copies of which may be obtained from the CRC headquarters. As part of the editorial activity, must be mentioned the preparation of the 1944 edition of the CFR Handbook, which embodies test methods applicable to fuels, a brief indication of the development of the CFR, and information resulting from some of its research. Indicating the growth of the CFR, the new edition will be almost twice the size of the first handbook issued in 1941.

A project carried out continuously by the CRC which, with the other major benefits, is largely educational, is the co-operative testing of fuel samples in laboratories throughout the country. For aviation and motor fuels, the quality tested is octane number, for Diesel fuels cetane number. In all cases, certain laboratories make up the group which tests identical samples each month, using specific CRC methods, and periodically, all owners of test equipment are permitted to participate. The National Bureau of Standards receives and analyzes the test results and issues reports covering the data. These exchange tests set up standards of precision in testing, indicate to each individual laboratory the extent to which its results conform to the average, and furnish the basis for a statistical study of the reproducibility of the methods and the trends in fuel characteristics.

Test Operators Trained

Two more specific instances of the CRC might be cited. The first is a set of instructions for the lubrication of wheel bearings, drawn up at the request of the Ordnance Department. The other is concerned with laboratory knock testing of aviation fuels. In accordance with the request of the Office of Petroleum Administration for War, supported by the Army and Navy, arrangements have been made for the training of operators of the aviation super-charge knock test unit, as experience has indicated it is extremely difficult to secure reliable results with this engine without thorough instruction and training. Four regional forums for engine operators have also been held, the total attendance being 200. Information developed in individual laboratories on methods of operating and maintaining these units is circulated to all owners of the test equipment through the CRC headquarters. This continuing educational program has been found so beneficial that a similar undertaking has been organized for laboratories using the CFR Research and Motor Methods.

These items of the work of the CRC cited above indicate its scope. Some figures taken at random will indicate the degree of its activity. Of 5 procedures for engine oil qualifications, 975 copies have been requested and distributed, and 6850 copies of the report forms, involving 96,000 sheets. Eighty thousand copies of two report forms for use with an aviation fuel knock test method were sold during one month. To users of this method, more than 3500 pieces of informational literature were sent during four months. The mailing list now includes 95 names and requires 275 sets of material for each periodic mailing. One fuels group prepared a total of more than 100,000 gallons in special batches of test fuels. The CRC embraces more than 150 active projects, which have occasioned two hundred meetings during the past year; the reproduction of minutes and reports alone required the cutting of 6000 stencils.

Planning Gas Compressor Stations For Long-Range Efficiency

*By Bruno Thiel**

The increasing use of refinery gases and gas derivatives in the manufacture of petroleum products, the recovery of light compounds in natural gasoline plants and the growth of recycling operations in oil fields point to additional gas compressor stations in the future, despite the large number of wartime compressor installations. Factors to be considered in designing stations for long-range efficiency, stability and economy are outlined as a basis for meeting the particular problems of the individual installation.

ALTHOUGH the modern gas compressor station is the result of practical experience and the application of engineering principles over a considerable period of time, we find there are changes that can be made in its design which will improve its efficiency.

The first compressor stations consisted of non-condensing steam engine belt driving gas compressors and were followed by the direct driven steam compressors, in which the compressor piston rod was a continuation of the steam engine piston rod, the compressor cylinder being mounted at the rear of the steam cylinder. The first gas engine driven compressors were those where a gas engine cylinder had replaced the steam cylinder on the steam engine bed or main frame. The cheapness and availability of natural gas aided the development of the gas engine and, at the turn of the century, the progenitor of the modern, horizontal, direct driven, gas engine powered, gas compressor was evolved. From that time until this, great strides have been made both in the design and dependability of the gas engine driven compressor and its auxiliaries.

Foundations

The base should be a mat extending under and beyond all compressor foundations unless these foundations rest upon solid rock, in which case they should be insulated from the rock by some vibration-dampening material such as cork. The mat should be large enough to extend to within a foot or so from the building foundations, but should never extend to or under them, as this would transmit any engine vibration to the building walls.

If the ground at the station site is insecure, piles should be driven to solid ground with the outside row of piles sloped with their tops toward the center of the mat. The tops of the piles should be incorporated in the bottom of the mat by means of re-inforcing steel. This will prevent, as much as possible, transmission of the engine vibrations to adjacent structures. All of the compressor foundations in any one building should be set on the mat in that building and securely anchored to it. This is the best means of breaking up any horizontal shaking forces, as the shaking forces of one unit will have a tendency to counteract the forces of another unless all units are synchronized with each other, a condition that does not exist in a compressor station except for short periods of time. The lower or tension side of the mat should be well re-inforced and keys should be cast into the top of the mat at those surfaces where the compressor foundations are to rest, so as to tie the mat and the compressor foundations into one solid mass.

Basement Is Convenient

The question of whether to have a basement in a compressor station has been discussed pro and con for many years but the convenience of a basement outweighs any additional cost that may be caused by the construction of a basement.

The station basement should be built high enough and the basement piping so arranged as to allow plenty of head room and working space around the piping. It should be provided with facilities for proper ventilation. Most basements are now built with but half of their height below ground level which allows for the installation of full size windows in the basement and makes it available for the storage of spare parts and operating stores such as oil and waste. Room for placing a bench for light repair work can also be provided in the basement, making it handy for the repair crew on rush repair jobs.

The compressor foundations should be keyed into the mat and well re-inforced at all points subject to tensile stress. All foundation bolts should be surrounded by a pipe or duct whose diameter is at least 2.5 times the diameter of the bolt and extends into the foundation for a distance of at least 15 times the diameter of the bolt. These ducts should be kept free of concrete when the foundation is poured. This is done to facilitate lowering of the engine base over the foundation bolts. On the large horizontal units where the foundation bolts are very long, the duct runs down to the foundation washer so that the bolt can be removed when the engine main frame is skidded onto the foundation.

The foundations are generally built with a step or shelf in them approximately 14 in. below the floor line, which acts as a support for the floor beams. A step or shelf may also be put in the building wall foundation for the same purpose. When the floor is poured a strip of insulating material such as pitch impregnated felt at least 1 in. thick is put between the edge of the floor and the foundations. This prevents any horizontal forces from being transmitted from the engine foundation to the building wall. By judicious spacing of the foundations no additional supports for the engine room floor will be necessary in the basement leaving all basement passageways unobstructed.

When grouting an engine the grout should never exceed 1½ in. in thickness and should be practically the same thickness over the entire foundation top. This eliminates excessive and uneven shrinkage, which might throw the unit out of line after the grout has dried. All leveling wedges and plates should be removed after the grout has set.

Cooling System

Although the lack of clean scale-free cooling water has wrecked more gas engine installations than any other one thing. this fact was not appreciated by the operators until a few years ago. The days when the engine cooling water is taken from a creek, pond, or open cooling tower basin should be over for all gas engine installations except those of the most temporary nature. In the earlier installations the temperature differential between the incoming and outgoing water ran anywhere from 40° to 100°F. These large temperature differences caused undue strains in the engine cylinders and cylinder heads and no doubt were the cause of many a piston seizure, where the piston was not water or oil cooled. The present day practice is to hold the temperature differential at 20°F. or less, with resultant better operation and lower maintenance costs. This involves the use of larger circulating pumps, but in the long run will decrease the maintenance sufficiently to offset the cost of the additional pump capacity.

The ideal is a closed cooling water system. In an open system where the water is cooled by means of a cooling

*Consulting Engineer, Cooper-Bessemer Corp., Mount Vernon, O.

tower the daily make-up water is never less than 5% which causes an accumulation of mud or sludge in the cooling water tower basin great enough to necessitate the draining of the system and cleaning of the tower basin every few months if the formation of scale in the engine jackets and cylinder heads is to be held to a minimum. Then, too, the absorption of oxygen in the form of air makes the water highly corrosive when it is heated and the oxygen is released in the engine jackets and heads. This is particularly true in water cooled piston rods, as the oxygen will attack steel with greater avidity than cast iron.

In a closed system the amount of make-up water is almost negligible provided the system is free from leaks. The most reliable closed system is where the pump draws the water from the overflow tank or standpipe and forces it through the heat exchanger and the engine to the overflow in the overflow tank or standpipe. The tank or standpipe should have its cover vented to the atmosphere and be so constructed that the water surface exposed to the air is a minimum.

Arrangement of Water Lines

The overflow line from the engine should enter the standpipe a short distance below the normal level of the water so as to prevent any splashing, as this would increase the amount of air dissolved in the water, but should be high enough to provide for a continuous slope upwards from the engine to the standpipe. This will release any entrained air or gas in the cooling water stream. In fact all piping should have an upward slope from the time it leaves the pump discharge until it enters the standpipe.

If, due to necessities of design, the water piping must deviate from a continually rising line at any point, an automatic air vent or a small bleeder line should be installed at the high point in this line. The system should be filled with treated water of approximately the analysis shown in Table 1 and any make-up water should be of the same analysis.

The lime-soda process, which changes the soluble calcium and magnesium bicarbonates to insoluble compounds that are precipitated and filtered out, is somewhat more complicated and expensive but is also more efficient. These treatments remove the scale-forming compounds from the water. In addition to these there are treatments with potassium or sodium dichromate to prevent oxygen corrosion and with chlorine or copper sulfate to prevent the growth of algae or other micro-organisms.

Constant Differential

In order to maintain a nearly constant differential temperature between the inlet and outlet water temperatures, an automatic bypass should be installed around the heat exchanger. This bypass is actuated by the temperature of the water leaving the engine. Should the outlet temperature of the unit fall below the predetermined temperature, enough water will bypass the cooler to raise the temperature at the engine outlet. This type of regulation is based on a heat exchanger large enough to take care of the entire output of the engine at peak loads with a constant supply of raw water.

The same result can be arrived at by regulating the flow of raw water to the heat exchanger by means of an engine outlet water temperature controlled valve. This system requires a raw water pump of sufficient capacity to take care of the cooling at peak conditions. This system is generally used where raw water is used for other purposes and an abundant supply is available.

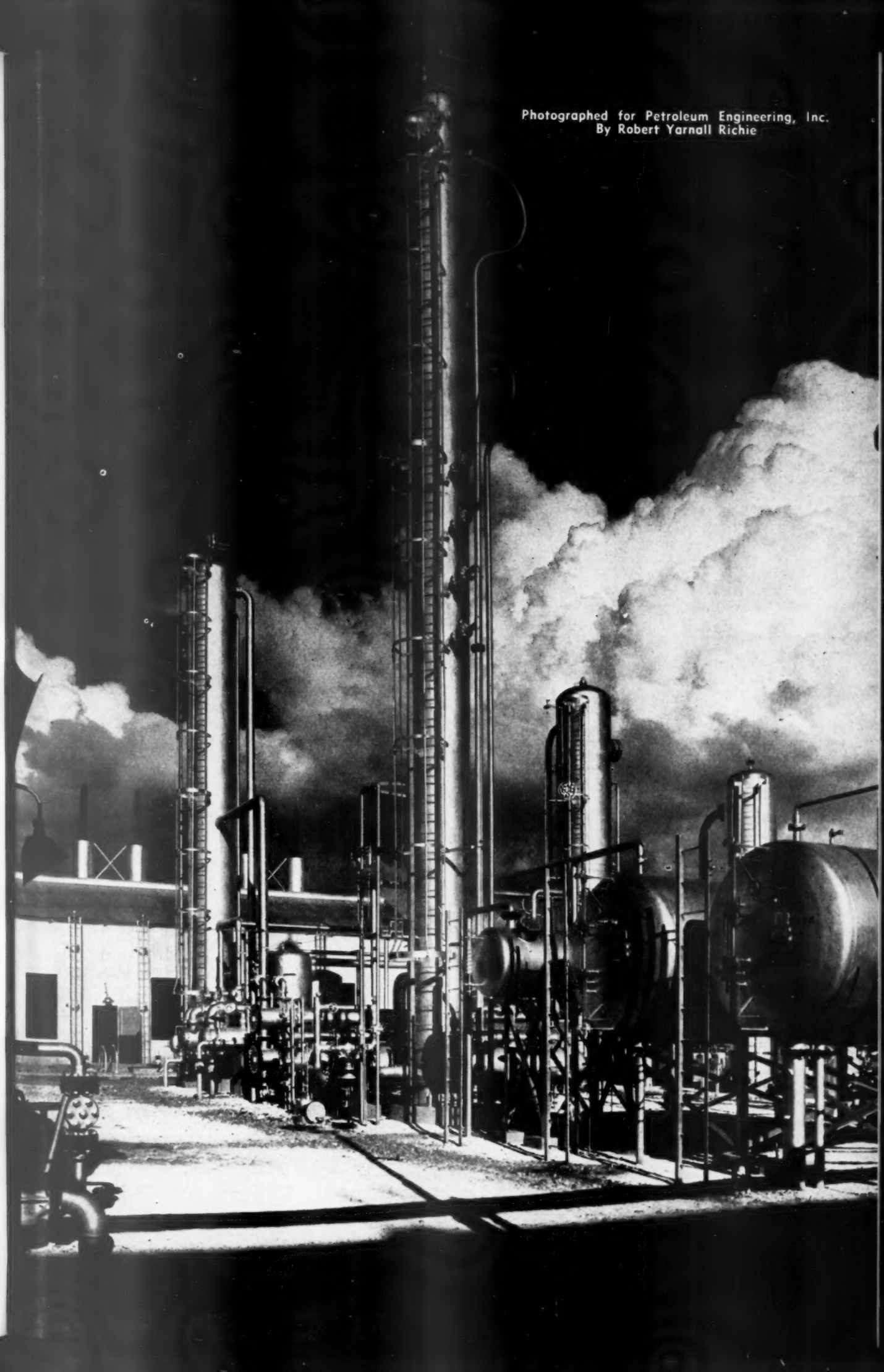
For best results the oil coolers should be served from a water system separate from the main engine water supply. All water piping should be calculated for water velocities not exceeding 4 ft. per second and in case this velocity creates too great a pressure drop due to long pipe lines, the pipe size should be increased. The quantity of water necessary to cool an installation containing 1000 bhp in main units is 525 gal. per minute for a 20° F. differential, 700 for a 15° F. differential, and 1050 for a 10° F. differential. These quantities contain the cooling water necessary for the auxiliary engines and other auxiliaries requiring cooling, and are based on the heat dissipation of an oil cooled piston

Table 1—Analysis of Treated Water Suitable for Gas Compressor Cooling System

Dissolved Oxygen:	—Preferably zero, but not over 0.05 cc per liter.
pH value:	—Not less than 8.
Oil:	—None.
Suspended solids:	—None.
Hardness:	—Calcium and magnesium sulfates added, not over 15 parts per million. Calcium and magnesium carbonates added, not over 75 parts per million.
Organic matter:	—Not over 5 parts per million.
Chloride:	—Not over 6 parts per million in terms of chlorine.

There are many types of water treatment. The simplest is the zeolite process which removes the calcium and magnesium compounds by substituting sodium for the base in these compounds.

A view of one of the several cycling plants designed and constructed by Petroleum Engineering, Inc. Manned by dozens of technicians skilled in their respective specialties, this organization is constantly at work . . . and has been for 15 years . . . taking over the processing problems of producing and refining property owners to design and erect natural gasoline plants, repressuring plants, vapor recovery plants, and "pure" hydrocarbon plants. Petroleum Engineering, Inc. Offices: Tulsa, Houston.



Photographed for Petroleum Engineering, Inc.
By Robert Yarnall Richie

two-cycle engine with water cooled exhaust manifolds.

One of the most necessary accessories in a gas engine compressor station is an air filter on the free air line to the engine. In most locations the atmosphere around a gas compressing station carries enough abrasive grit to warrant the installation of an air filter.

Air Filters

An excellent example of what an air cleaner can do was indicated by an inspection of a compressor station located in the dust bowl. One unit was equipped with an air filter having a constantly traveling filter belt moving through an oil bath at its lower turn, about one year after it was put into service. The other three units in this station were left without air filters. After 11 years the maximum wear in any cylinder on the unit with the air filter was .033 in., with an average wear over all 8 cylinder ends of .025 in. making the average yearly wear for the unit a little more than .002 in. per year.

The other units in this station operating under the same conditions but without air filters had an average wear of .018 in. per cylinder end per year, or an average total wear of .198 in. per cylinder end throughout the 11 years of operation. In cases of this kind the air filter would allow the engine with the filter attached to operate 9 times as long as the engines without the filter before the reboring point was reached. This is concrete evidence that the cost of the air filter is repaid many times over by reducing the wear on the engine cylinders.

In installing an air filter care must be taken to provide one large enough so that the restriction it produces does not create too great a pressure drop between the outside atmosphere and the engine cylinder. This must be watched more closely in a two-cycle unit than in a four-cycle unit, due to the fact that a slight pressure drop in the air going to the scavenging cylinder of a two-cycle unit will produce a greater effect on the maximum power that the engine can develop than in a four-cycle unit. In both types, however, any restriction in the free air line will tend to enrich the mixture in the cylinder and cause the engine to run hotter than normal. This may cause overheating and lead to the seizing of the pistons.

Exhaust

The two-cycle engine is more critical in regard to the length of its exhaust pipe than the four-cycle engine. Engine builders have conducted experiments to ascertain the most favorable length of exhaust line to use on any one particular unit. If a muffler is included in the exhaust line, its effect should also be included as it will affect the length of the exhaust line between it and the engine and between it and the atmosphere. Data on these points are available from the engine builders.

Oil Cooler

If the compressor is equipped with oil-cooled power pistons, an oil cooler is a necessity and should be so chosen that the pressure drop through the cooler is at a minimum with a maximum heat exchange capacity. These coolers should be so constructed that the tube bundle can be removed for cleaning. No matter how clean the filter may keep the oil, there will always be some sludge settle out in the oil cooler. The cooling water circuit that supplies the water to the oil cooler should be divorced from the main compressor circuit, as there may be times when the compressor is forced to operate at higher temperatures than are correct for the oil system.

Oil Filters

As most oil cooled piston engines use the circulating system lubricating oil as a coolant, the oil system must contain filters that are capable of taking care of its full flow. Most units also have a waste type bypass or bleeder filter that removes the finer particles and sludge from the oil. As these filters are very efficient, the outlet may be bypassed through the cylinder lubricator tanks so as to keep a constant level in these tanks.

Piping

In the past the amount of gas delivered by a compressor station has been used as a basis for calculating the pipe sizes used there. This method of calculation assumes that the gas is flowing in a continuous stream from the compressor while it is in operation. What actually happens is that the compressor takes in gas during only a portion of its entire stroke and discharges it during only a portion of the next stroke, the amount taken into the compressor cylinder and delivered by it during one revolution being dependent upon the volumetric efficiency of the compressor cylinder. However, the rate at which the gas is taken in or discharged depends upon the velocity of the piston during the time the gas is flowing to or from the compressor cylinder.

For example, in a double acting compressor cylinder having a piston displacement of 100 cu. ft. per minute when operating at a speed of 300 rpm and having a volumetric efficiency of 85% during the suction stroke and volumetric efficiency of 35% during the discharge stroke, the cylinder will take in .2833 cu. ft. of gas during one revolution of the crank and discharge .1167 cu. ft. during the same period. If the compressor cylinder driving mechanism has a crank to connecting rod ratio of 1 to 5, the time consumed during the suction stroke, measured in the time of one stroke, will be 72.14% of the forward stroke and 76.74% of the return stroke or 74.44% of the time of one revolution.

Calculating Pipe Size

As the time of one revolution is .003333 minutes, the time required for the compressor cylinder to take in .2833 cu. ft., which is the quantity of gas taken in during one revolution, is .002481 minutes. Then the average rate at which the compressor cylinder takes in gas is 114.3 cu. ft. per minute. This means that the suction pipe leading to the compressor cylinder must be capable of handling gas flowing at the rate of 114.3 cu. ft. per minute instead of 85 cu. ft. per minute, as 114.3 cu. ft. per minute is the average rate of flow to the compressor cylinder during the time it is taking in gas. If the pipe is calculated on 85 cu. ft. per minute it will have 74.4% of the proper area. In the same manner we find that this compressor cylinder will discharge gas during 40.44% of one revolution or .001348 minute during which time .1167 cu. ft. are discharged at an average rate of flow of 86.6 cu. ft. per minute. A discharge line based on the discharge capacity of 35 cu. ft. per minute would have 40.4% of the required area.

If the pipes leading to and from a compressor cylinder are too small the pressure drop through these lines will decrease the capacity of the compressor cylinder and increase the power to compress a unit volume of gas. This is often the reason why compressor stations that are correctly designed as far as horsepower and capacity are concerned do not deliver their rated capacity or are overloaded when put into operation.

The intercoolers in a two-stage installation and the aftercoolers in any installation should be calculated for pressure drop using the average rate of flow as outlined above. A restriction here can cause as great a power and capacity loss as too small a pipe size. In a station containing more than one compressor the headers connecting these compressors should be large enough to take care of the gas flowing to or from the compressor cylinders when all units are synchronized, basing the rate of flow upon computations similar to those given above. If this is not done the capacity of the station will be decreased and the horsepower per unit volume increased.

Loss in Power Results

Horsepower losses have reached as high as 33% of the productive horsepower in instances where the piping was known to be undersize. Where two or

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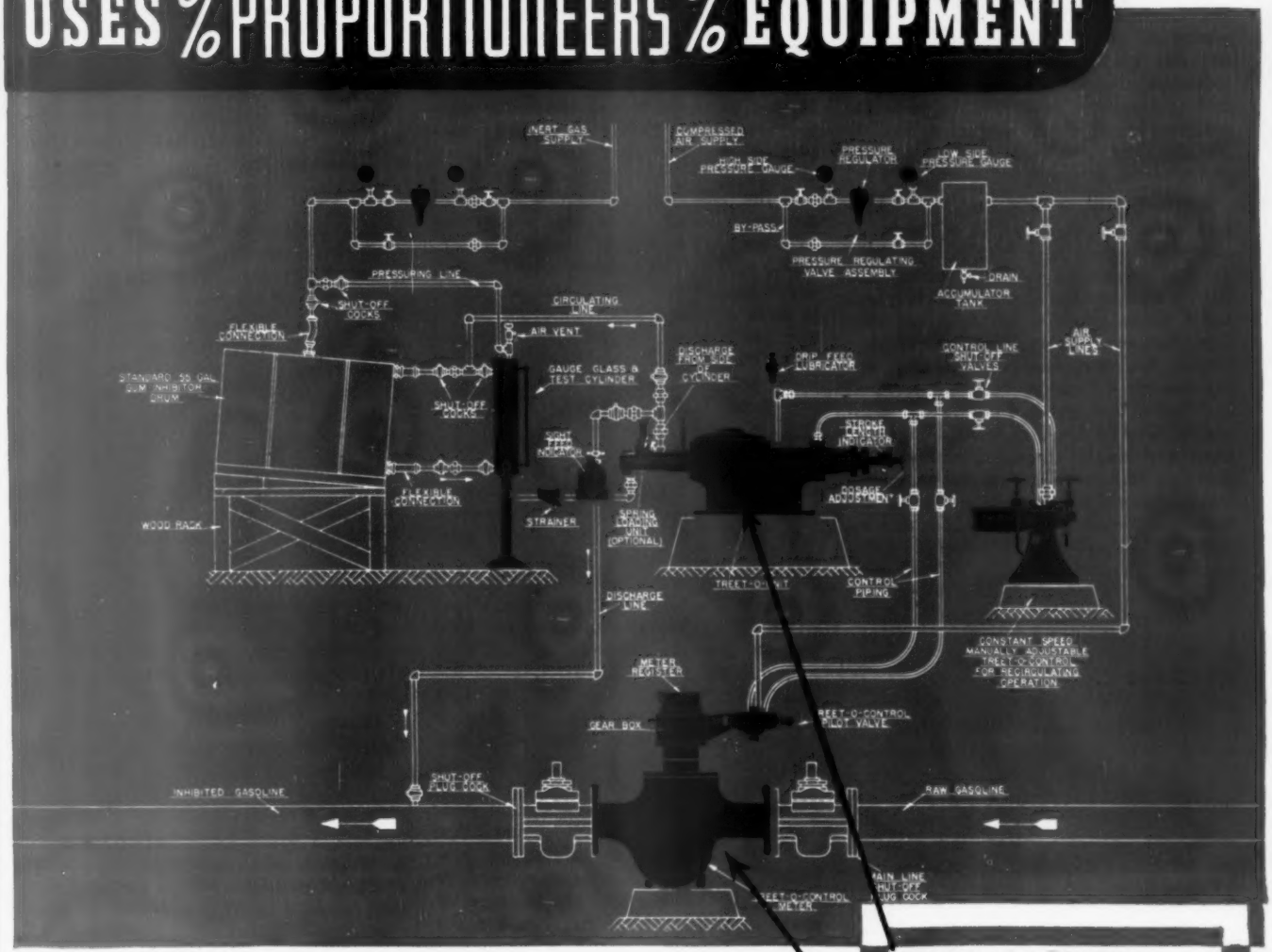

INJECTING INHIBITORS INTO GASOLINE

A typical refinery layout is shown for injecting U.O.P. and other inhibitors in exact proportion to the gasoline flow. The %Proportioneers% Treet-O-Control Meter with Pilot Valve is controlled by the flow of gasoline, and actuates the %Proportioneers% Treet-O-Unit Pump through an air circuit to automatically inject the correct inhibitor dosage. %Proportioneers% flow responsive Treet-O-Control equipment assures maximum accuracy over the widest treating range, and so thoroughly disperses the inhibitor that it is unnecessary to recirculate the gasoline.

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%Proportioneers% builds complete equipment for gasoline, lube oil and asphalt blending, as well as gasoline treating, water treating, corrosion inhibiting, and other refinery applications. For further information write for Bulletin 1700.

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more compressor cylinders on the same service are mounted on the same unit the installation of a large header supplying all of the cylinders will increase the efficiency of the unit. On single cylinders the installation of an intake and a discharge tank will increase the compressor efficiency and also tend to mitigate any pulsations set up by the compressor.

Theoretically it requires less horsepower to compress gas in a two-stage compressor than in a single-stage compressor for any set of conditions but, due to additional mechanical friction and valve losses, this is not true actually. The two-stage horsepower curve lies above the single-stage curve until approximately 4.5 compressions are reached and from this point the two-stage installation will require less horsepower than the single stage. However, the dividing line between single and two-stage compression in any particular installation depends not only on the installed horsepower but also on the economies of the installation. This in turn depends upon so many variables that it is a lengthy problem in itself.

Safety Devices

The newer compressors can be equipped with a number of safety devices and controls. The common safety devices such as the overspeed stop, and the safety stops actuated by low lubricating oil pressure, high cooling water temperature, and subnormal cooling water flow have been in existence for some time and now we have safety devices that can be attached to the bearings that will shut down the unit if the bearing temperature becomes excessive or if the play in some of the moving parts becomes too great.

The number of controls that can be used on a present day compressor are many, and with various combinations of them practically any type of operation can be controlled. The output of a compressor may be regulated by the suction pressure, the discharge pressure or the quantity of gas compressed. The quantity of gas compressed can also be varied automatically by changing the speed of the compressor up to a certain point and by clearance pockets from there on until the output of the compressor is zero. The torque of a compressor can be controlled so that in an installation called upon to handle a wide range of suction and discharge pressures there can be no danger of overloading the unit when pressure conditions exist that might damage the working parts of the machine. This is done by unloading the compressor cylinder when it is operating in an unfavorable pressure range.

Station Buildings

The use of medium speed engines for driving compressor cylinders has decreased the size of the buildings necessary to house the main units in a compressor station. Taking a 6000-hp. main line station consisting of six 1000 V-type engines as an example, we find that the floor space required is .7563 sq. ft. per horsepower and the cubic content required is 12.634 cu. ft. per horsepower. In this arrangement we have allowed 10 ft. between the end engines and the end wall and a 5-ft. alleyway around all units. The same horsepower in slow speed engines would require 1.737 sq. ft. per horsepower and 24.313 cu. ft. per horsepower. Then, too, there is quite a saving in concrete in the engine foundations, the medium speed engine requiring 140 cubic yards and the slow speed engine 250 cubic yards, a saving of 90 cubic yards or 36%.

The standard main line station building generally consists of a steel framework resting on a solid concrete basement wall that is carried up to the main floor level. The basement floor is generally not more than 4 ft. below the grade line, which allows the compressor piping to come out of the station above grade. The outside headers are then laid on concrete supports and all outside valves are in plain sight of the operators. Catwalks are built to each valve for the convenience and safety of the operators. A solid brick wall is carried from the floor to the top of the window sill and corrugated transite is used for the rest of the wall and roof. The windows are steel sash ventilating type and should be as air tight as possible. Although considered a needless expense by some an overhead crane of some sort is essential in reducing the maintenance cost. This crane should have a capacity of not less than two tons.

The heating of a compressor station building can be done by an exhaust gas furnace or boiler supplemented by a gas or oil fired boiler for emergencies. In the dust bowl region some stations are supplied with water washed air which has considerable bearing upon the maintenance cost of units. Another innovation is the placing of the motor driven water pumps in a dog house at the cooling tower and having them remote controlled from the switchboard in the auxiliary house. This decreases the length of the water lines and also decreases the size of the auxiliary building. The auxiliary building is of the same general construction as the main building but without a basement. In it are the auxiliary engines direct connected to generators, the air starting compressors, the station office, spare parts and supplies storeroom, lockers and wash room.

The foregoing analysis of a modern compressor station is general and each installation will have its own peculiar problems; but the points outlined here will serve as the basis for meeting the conditions of the individual installation.

BOOK REVIEWS

6th Edition Has New Data On Flow Measurement

"Principles and Practice of Flow Meter Engineering," by L. K. Spink of Foxboro Co., Foxboro, Mass., has been revised and enlarged in the 6th Edition to include available data on measurements of rates of flow of fluids in closed pipes. It is compiled from reports of investigations by the American Gas Assn., Bureau of Standards, Bureau of Mines, American Society of Mechanical Engineers and the California Natural Gasoline Assn., as well as contributions from well-known engineering firms including the M. W. Kellogg Co., E. B. Badger & Sons Co., Lummus Co. and Universal Oil Products Co.

Comprising some 212 pages of textual matter and data tables, it is a wealth of practical information and data on fluid-flow mensuration. Of particular interest to the oil industry, special equations are developed for use with orifice meters measuring flow of petroleum oils, gases and water, which include use of meter coefficients, selection of orifice size and thermal expansion of petroleum products.

The book is divided into two parts: Liquid-flow measurement and gas-flow measurement. These are in turn divided into several sections, as follows:

Liquid-flow measurement: Determining rate of flow (by volume), orifice plate coefficients, chart computation, direct-reading liquid-flow meters, working section; each is appropriately sub-divided.

Gas-flow measurement: Coefficients, chart computations, square root planimeter, fundamental of commercial measurement, all based on American Gas Assn. committee report No. 1; gas flow measurement, based on A.G.A. committee report No. 2.

Aside from the general index, a summary of equations is given for each of the two parts with citations to that portion of the work dealing with that specific point. Citations are at the edge of the page, in the form of arrows; the corresponding page has a black mark on the edge to simplify turning to it. The book may be purchased through the Book Department of NATIONAL PETROLEUM NEWS, 1213 W. Third St., Cleveland, for $3 postpaid.

New Standards List Ready

The American Standards Assn. has published its new list of standards which will be sent without charge to anyone interested on request. Of the more than 600 standards listed, 64 have been approved or revised since the last price list was printed in April, 1943. Requests should be addressed to the American Standards Assn., 29 W. 39 St., New York 18, N. Y.

What happens to gasoline vapors when the temperature goes UP?

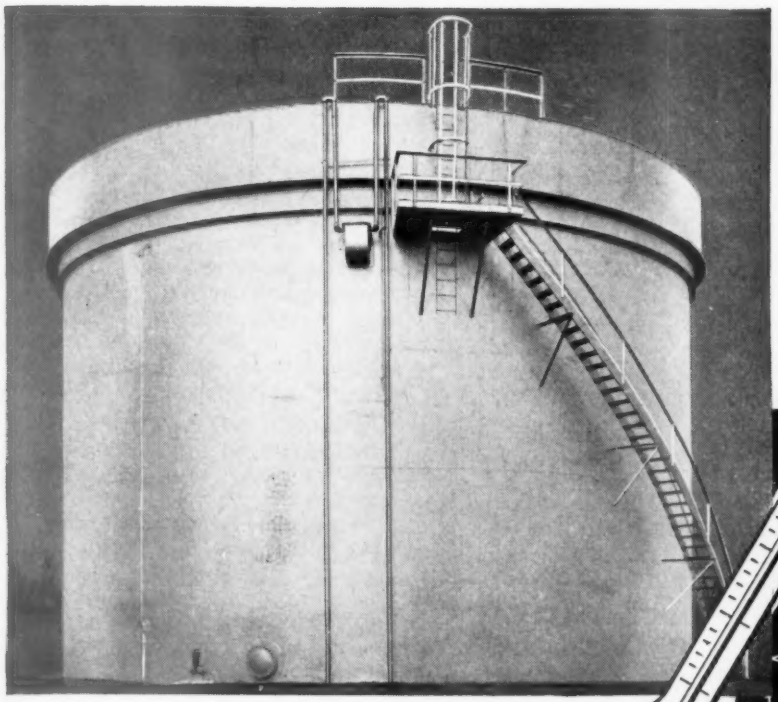

Photo above shows a Graver Expansion Roof Tank installed for a major oil company. Diameter 52'6". Height 38'11". Capacity 15,000 bbls. Expansion capacity 11,060 cu. ft. Roof rise, 5'.

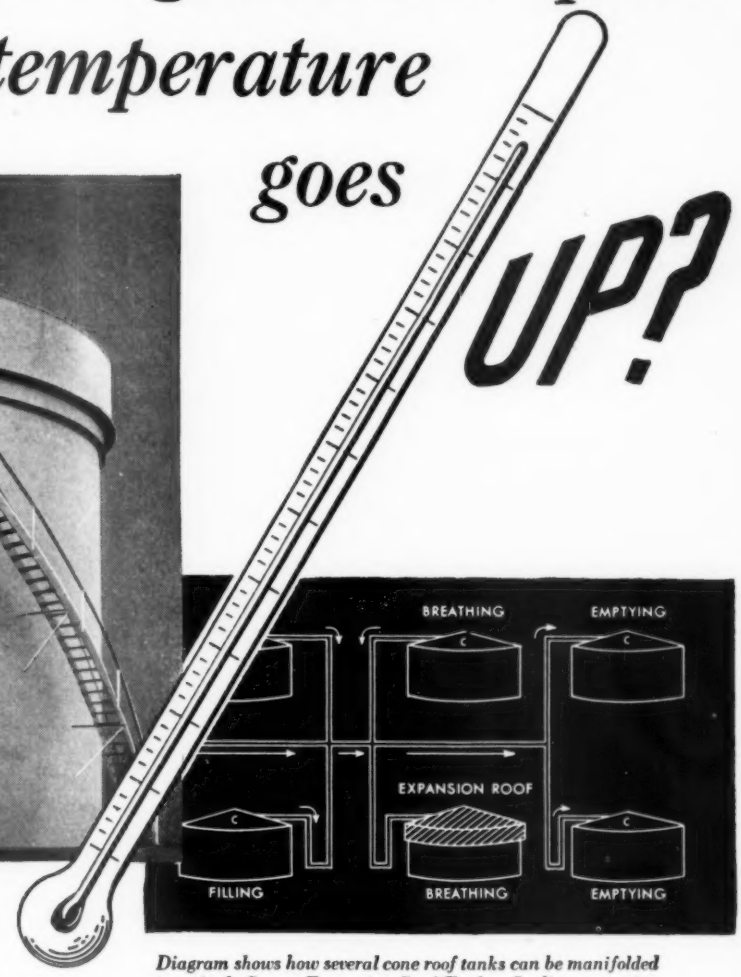

Diagram shows how several cone roof tanks can be manifolded to a single Graver Expansion Roof Tank, affording protection to the entire group.

When temperatures rise and gasoline vapors expand in an ordinary cone roof tank, there's one certain result . . . loss of gallonage. These vapors have to go somewhere . . . so they're expelled. And authorities state that in a 10,000 bbl. cone roof tank this loss will equal 16,800 gallons per year.

A Graver Expansion Roof Tank absolutely prevents this loss. The roof rises or falls as the vapors expand or contract, so that they are held within the tank and not expelled. And . . . if a group of cone roof tanks are spaced reasonably close together, they can be manifolded to a single Graver Expansion Roof Tank of suitable size, affording complete protection to *the entire battery* . . . a saving in gallonage and maintenance of octane rating as well.

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Homemade Flashlight Battery Recharger Reduces Replacement Cost by 70%

SHELL OIL CO. at its Martinez, Calif., refinery, has worked out a method of recharging dry cell flashlight batteries which it is reported will permit the batteries to be re-used from 5 to 7 times, with the life per charge comparing favorably with that of new batteries. The renewed batteries lose their charge in storage and so are not used for intermittent service.

By this method of recharging, the company states that battery replacement cost at the refinery has been reduced approximately 70%, with comparable savings in critical material for battery construction. This figure is based on replacement data of 30,000 unit flashlight batteries and 1000 6-volt type batteries for hand lanterns annually, at a respective rate of 5.66c and 33.5c apiece or a total cost of approximately $2000 a year.

Charger Simply Built

A recharging unit was built which would simultaneously recharge approximately 40 unit flashlight cells. General plan of the equipment and diagram of connections are shown in Figs. 1 and 2. The charger is constructed so that neither the individual rack nor all racks need be full of cells during charging operations. Electrical material needed is commonly found in most refinery electric shops, and the sheet metal, transite and rods can be of most any convenient substitute materials. Labor constitutes the greater part of construction cost. Operating costs will be found negligible. The only unusual requirement is a source of direct current, which in most instances can be supplied without great difficulty. Shell's DC supply is obtained from synchronous motor exciters, located next to the electric shop.

In practice, the discharged cells are placed on top of one another until the rack is filled, the positive contact follower being placed firmly on the center terminal of the dry-cell. Power then is turned on. The 10-watt lamps serve to indicate when current is flowing and also to limit the amount of current any one rack can receive.

Charging Takes 16 Hours

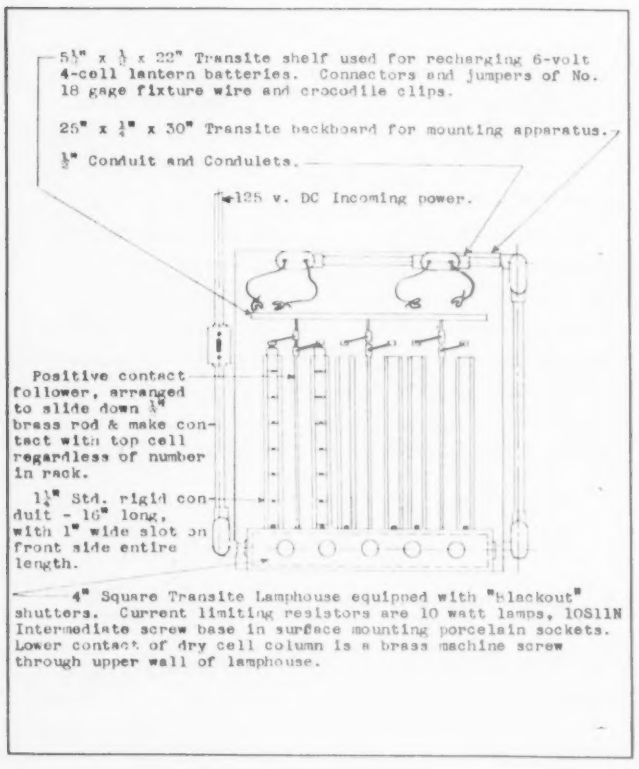
The amount of time a cell should be on charge will depend on conditions imposed by the individual charger equipment. Shell's experience indicates that 16 hours is sufficient charging time for the average cell, if constructed according to Figs. 1 and 2.

After the batteries are placed in the rack and power turned on, no further attention is required until charging period is completed. Power then is turned off and batteries are removed to storage. On the average, recharging requires about 15 minutes of the shift electrician's time.

"The total number of times each battery can be recharged seems to depend primarily upon the speed with which the battery is discharged," the company reported. "New batteries which are discharged in a few nights' use can be recharged within the next week and this cycle can be repeated 5 to 10 times before failure results. A battery is considered as having failed when the zinc casing is corroded through.

"It has been noted that recharged batteries lose their charge if placed in storage for any considerable period, it being necessary to use them within a week or 2 of recharging. Therefore no attempt is made to utilize them on intermittent service, such as the 'emergency lights' which are kept at various locations for use in emergencies only.

"The distribution of flashlight batteries at Martinez refinery has usually been handled by the shift electrician, partly for control purposes. Operators requiring a battery charge are furnished replacement batteries upon surrender of the old batteries. Therefore, the existing setup was ideal for collecting discharged batteries for recharging. Battery users were naturally skeptical when informed they were being supplied with recharged batteries, but within a short time were requesting recharged batteries, as they give a slightly brighter light with length of service comparable with new batteries. Globe replacements have not increased."


5½" x ⅞ x 22" Transite shelf used for recharging 6-volt 4-cell lantern batteries. Connectors and jumpers of No. 18 gage fixture wire and crocodile clips.
25" x ¼" x 30" Transite backboard for mounting apparatus.
½" Conduit and Condulets.
125 v. DC Incoming power.
Positive contact follower, arranged to slide down ½" brass rod & make contact with top cell regardless of number in rack.
1½" Std. rigid conduit - 16" long, with 1" wide slot on front side entire length.
4" Square Transite Lamphouse equipped with "Blackout" shutters. Current limiting resistors are 10 watt lamps, 10S11N Intermediate screw base in surface mounting porcelain sockets. Lower contact of dry cell column is a brass machine screw through upper wall of lamphouse.

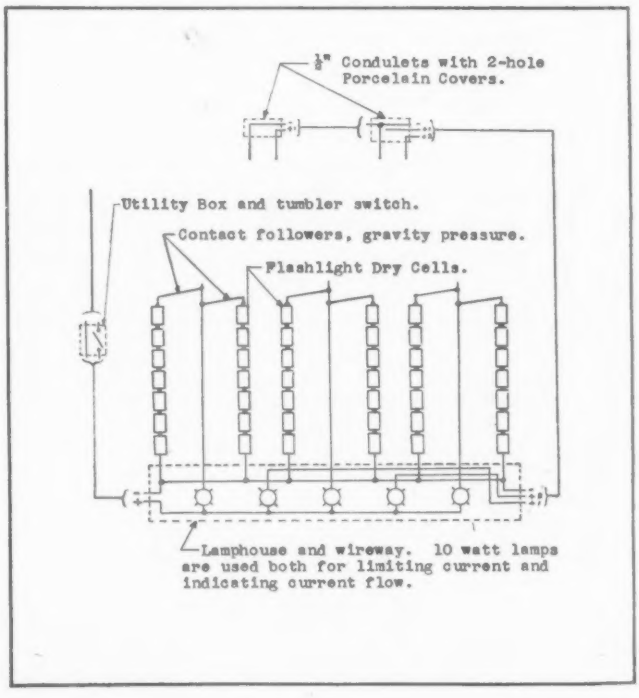
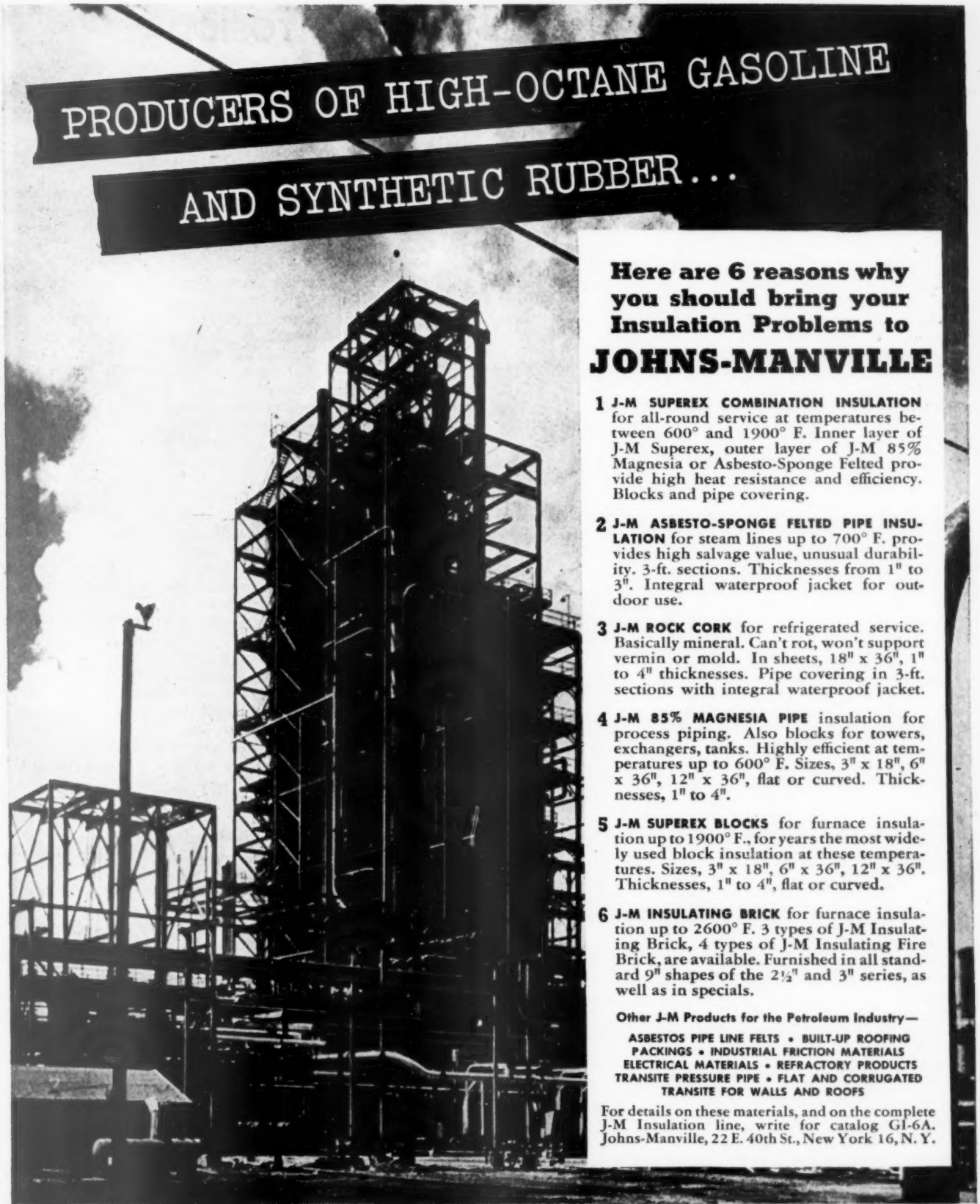

½" Condulets with 2-hole Porcelain Covers.
Utility Box and tumbler switch.
Contact followers, gravity pressure.
Flashlight Dry Cells.
Lamphouse and wireway. 10 watt lamps are used both for limiting current and indicating current flow.

Fig. 1 (Left)—Dry cell recharger, assembling diagram
Fig. 2 (Below)—Dry cell recharger, wiring diagram



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Resisting Condenser Tube Corrosion*

Presenting Some Methods for Overcoming Corrosion Due To the Processing of High Sulfur Crudes

IN THE REFINING OF PETROLEUM and production of natural gasoline, non-ferrous alloys find a growing application in condenser and heat-exchanger tubes. The increasing production of materials of a chemical nature, such as high octane gasoline, synthetic rubber components and chemical solvents, accentuates corrosion problems. The use of crudes high in sulfur and mineral salt content makes corrosion attacks probable in plants hitherto largely untroubled from this source. Hence the choice of metal for this and other equipment is becoming more important.

The most common causes of corrosion are found to be hydrogen sulfide, hydrochloric acid, ammonia and scale-forming compounds in cooling water or product. Hydrogen sulfide occurs naturally in many crudes, or it may be formed during cracking operations which decompose many organic sulfides. It is one of the worst offenders, especially at elevated temperatures or when moisture is present. Neutralizing chemicals are found effective in cutting down the severity of corrosion.

Hydrocholoric acid is generally produced from decomposition of mineral chlorides during distillation or is present as a contaminant in the crude from acidizing treatment in the well to increase flow from the oil-bearing strata. It is neutralized by strong alkalies or ammonia. If excess ammonia is used, it may be a cause of corrosion of copper-base alloys; other alkalies are not particularly corrosive.

Treatment of cooling water to eliminate scale-forming minerals is the most satisfactory way to eliminate trouble from scale forming on tubes. This may be accomplished by chemical treatment of the water, or mechanically by elevating water temperature and permitting the formation of scale where it can be easily disposed of. Also, several methods are available for removing scale from the tubes themselves.

As operating conditions vary so widely in different plants, specific recommendations for tubing can be intelligently made only after careful study of every individual condition. A number of different alloys are available which will satisfy most requirements. In addition, bimetal tubing made from combinations of two different alloys is now available for services where no single alloy will handle corrosive conditions existing on both sides of the tube.

Research has indicated that corrosion may generally be grouped into two types: electrochemical and galvanic. These may occur singly, or in combination. Two other types of failure also may occur, these being stress corrosion, where unrelieved stresses in the metal may render it more sensitive to attacks of chemical corrosion, and (2) fatigue or corrosion fatigue cracking, where rapidly-alternating stresses, as in the case of tubes under severe vibration, render the metal more susceptible to corrosion or cause the metal to break mechanically.

Electrochemical Corrosion

Electrochemical corrosion is quite common, receiving its name from the electrochemical theory of chemical reaction, which applies more particularly to inorganic (ionic) reactions where attraction and repulsion between atoms takes place as they try to attain the most stable combination under existing conditions.

Since all metals tend to dissolve in water (or a solution of acid, alkali or mineral salts which conducts electricity) with the formation of hydrogen and metal hydroxides, the general effect of corrosion is the formation of a film on the metal which may or may not be visible. The visible films are frequently non-protective, while the invisible films generally are protective. Many films, however, have characteristics between these two extremes.

Visible films have been repeatedly observed to have the following characteristics:

1. They are permeable to fluids.
2. They are sufficiently dense to impede flow of fresh corrosive solution to the metal surface.
3. They are non-uniform (discontinuous), permitting corrosive solution to come into contact with metal in certain areas, while screening other areas.
4. Corrosion may be increased in certain screened areas by the formation of "concentration cells."
5. Metal under thicker portions of partially permeable films usually becomes pitted or attacked by local corrosion.
6. Exposed metal or metals covered by thinner films are only slightly corroded.
7. Continued accumulation of corrosion products of the same type helps to produce deeper pits or to enlarge the corroded area.

These properties of visible corrosion films aid in the formation of "concentration cell" (metal-ion and oxygen) types of corrosion. The cell begins to operate when the corroding substance is present in different concentrations at adjacent areas on the metal surface. The localization of corrosion is because differences in electrical potential exist between the various parts of the metal surface in the area; such corrosion is largely electrolytic (galvanic).

The invisible (often protective) films, which are frequently coatings of molecular hydrogen or very thin films of other corrosion products, generally are impermeable to the corrosive solution, hence protect the surface they cover. Commercial use is made of this fact in deliberate formation of such films to resist further corrosion attacks from further contact with the same corrosive solution, or with other corrosive solutions. For example, aluminum may be anodized in chromic acid to produce a thin oxide film on the metal; this treatment has considerable use in increasing the corrosion resistance of aluminum.

Oxygen has been proved definitely to accelerate corrosion, in that it combines with the ionic hydrogen produced when the metal dissolves in water (forming hydroxides), destroying the protective coating of neutral hydrogen molecules which otherwise would tend to develop. It has been found, for example, that the rate of corrosion of a metal in a natural water is almost directly proportional to its oxygen content. Other hydrogen acceptors have a similar effect.

Ever since it was learned that oxygen accelerates corrosion, numerous ingenious procedures have been developed in an effort to remove this corrosion rate factor. One such method consists of passing the water over scrap iron, where the oxygen reacts with it instead of the metal in condenser and heat exchanger tubes. Another method involves the addition of sodium sulfite to the water, which removes oxygen according to the reaction $2\ Na_2SO_3 + O_2 \rightarrow 2\ Na_2SO_4$. Still another mechanically removes oxygen and other gases from water by raising the temperature and lowering the pressure—based on the fact that solubility of gases in water is sharply reduced with increasing temperature and lower pressure if sufficient time is permitted for equilibrium to be attained.

In addition to de-aeration, it is desirable to remove any debris from the water. This may be effected by simple screens, or beds and towers packed with minerals or other materials. Some of these devices are designed to remove oxygen, calcium, dissolved or precipitated iron, sediment and carbon dioxide, depending on the problem.

Frequently, certain types of the thicker corrosion films form, which when locally broken or removed favor formation of a metal-ion concentration cell, or an oxygen concentration cell may change into the metal-ion concentration

*All material in this article is from the 1943 Condenser Tube Manual of the Bridgeport Brass Co., Bridgeport, Conn.

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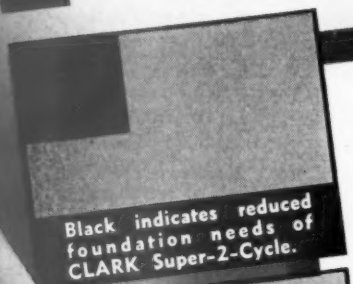

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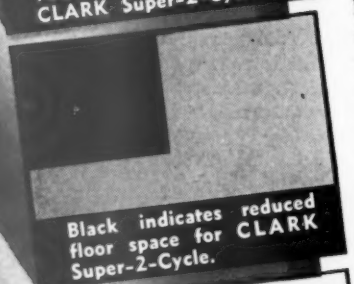

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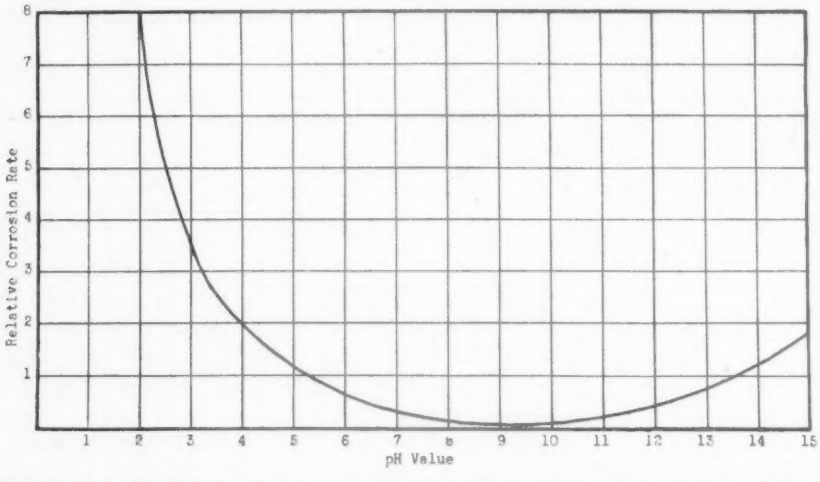

FIG. 1—Plot of relative corrosion rate for a typical copper-base alloy against pH value of the corroding solution. General form is the same for all such alloys, but shape and position vary with the metal and the constituents of the corroding solution

cell. This usually occurs in condenser or exchanger tubes when an impinging stream of fluid containing entrained gases wears through the corrosion scale and gains access to the pit beneath. When this happens, corrosion products in the pit are swept out, exposing the metal for renewed corrosive attack. Gradually the shape of the pit changes into the clean, almond or crescent-shaped area characteristic of impingement attack. It is nearly always undercut in the direction of fluid flow. Numerous pits of this type sometimes merge, giving a serrated, mountain-range appearance.

Because of the electrical potential existing between adjacent areas covered with a scale of corrosion products and the pit area covered with less or no corrosion products, crystalline deposits of metal may be found beneath the scale. This may be likened to a galvanic cell in which the scale-covered area acts as a cathode, while the pit acts as an anode. Metal ions formed at the anode area are swept away as fast as formed, hence have no chance to concentrate; the metal salts (corrosion products) in the scale or cathode area tend to be reduced and "plate out" as the reaction proceeds. If the flow of fluid changes, the point of impingement usually changes; the pit then immediately changes back to the oxygen concentration cell.

Galvanic Corrosion

Galvanic corrosion may be likened to the familiar flashlight battery, in which two dissimilar metals are coupled to each other in the presence of a solution which conducts electricity. In a condenser or heat exchanger, this may occur when a copper-base alloy is coupled to iron in the presence of a corrosive fluid, for example. The iron promptly becomes anodic and the copper-base alloy cathodic, while the corrosive fluid becomes the electrolyte. Here again the presence of oxygen or other hydrogen acceptors will accelerate the effect. The iron starts to corrode while the copper-base alloy is more or less protected; the rate of corrosion will vary with the ratio of the two areas involved.

Practically, the galvanic couple means that it increases or localizes a corrosion which, in a given environment, would have occurred whether the dissimilar metals were connected or not.

The methods of protection against galvanic cell corrosion include: impressing an electrical potential on the metals and artificially maintaining the metal which tends to corrode as the cathode; sacrificial protection of the metal, such as galvanizing the iron with zinc, and de-aerating the corrosive fluid.

Influence of pH

The corrosiveness of water, for example, depends in a highly complicated manner upon the concentration of mineral matter, organic matter, gases and debris. The influence of hydrogen ion concentration (pH) has been studied extensively and has been found to vary in its effect depending on the metal being corroded, the temperature and concentration of all other materials present. It may be said that usually an increase of hydrogen ions (low pH) accelerates the rate of corrosion.

The pH of a solution, when plotted against relative rate of corrosion of a given metal, graphically shows the effect of pH on corrosion. Such a curve for a copper-base alloy is shown in Fig. 1. Its shape may be taken as fairly typical for these alloys. For others, the slope would change, also minimum point, and the curve itself might be displaced in any direction.

It will be noticed that the curve indicates corrosion taking place both when pH value is low and when it is high, and that the least corrosion occurs somewhere in the neighborhood of pH 9 for this particular sample. This means that even though hydrogen-ion concentration is low, it is still enough for corrosion to proceed. However, in a closed system, pH will gradually rise and may tend to stifle the reaction, because the corrosion film may be less soluble at the higher pH and the hydrogen-ion concentration is lower. But, if amphoteric metals are present in the alloy, such as aluminum, corrosion rate will increase markedly with increased pH.

Illustrating the effect of other materials which may be present, a natural fresh water of pH 7 to 8 usually is much less corrosive than sea water with a similar pH; the mineral salts in the sea water are responsible for this difference.

Deposition of mineral scales sometimes may be a blessing. The most common scale, calcium carbonate, may build up a scale on metal surfaces which will stifle or suppress corrosion. Some specimens have been examined, thickness of film ranging from 0.0005 to 0.020 in., which reportedly prevented corrosion of the metal surface for generations. However, if the scale becomes too thick it may interfere with heat transfer to such an extent that the tube will fail through overheating; certainly there will be economic losses through reduced thermal efficiency of the condenser or heat exchanger.

Tube Metals in Refinery Exchangers

One of the most common alloys used in refinery heat-exchangers and condensers is Admiralty metal. A common modification is attained through the addition of 0.1% arsenic to resist dezincification. These materials stand up well in salt or polluted fresh circulating water, as well as with most petroleum products except those especially high in sulfur. It is not recommended for turbulent, high-velocity water applications.

To resist sulfur corrosion, Muntz metal containing a small amount of arsenic has been developed. Its high zinc content makes it stand up even better than Admiralty against sulfur attack, while the arsenic content resists dezincification from corrosive fresh or salt waters.

Red brass is sometimes used in the oil industry, especially where the circulating water is extremely corrosive. Because of its high copper content (85%), it is more subject to sulfur attack than yellow brass. It is not recommended for applications involving impingement corrosion.

Copper-nickel alloys are being used to an increasing extent where corrosion is apt to be severe. They will withstand higher temperatures than other nonferrous alloys although they should not be used for extremely high temperature service.

Duplex tubing finds its application where one alloy will not resist the corrosive materials present. Tubing made from steel (carbon or stainless) for the oil side and Admiralty, aluminum brass or copper for the water side have been developed.

To conserve metals, ways to avoid or

eliminate the principal factors which contribute to tube failure must be given prompt and serious consideration by every operator. Below are listed several practical suggestions to this end.

Use screens fine enough to prevent debris from entering tubes.

Treat water chemically or mechanically to minimize formation of mineral scale.

Use chemicals to inhibit growth of algae or other forms of water-life.

Clean tubes, chemically or mechanically, at regular intervals.

Avoid high fluid velocities and, if economically possible, de-aerate the water; also remember that corrosion rate generally is greater at high temperatures.

See that tubes are properly installed in condensers and heat exchanger.

Installation of Tubes

Design Details

Among the principal considerations in design details and the installation of condenser tubes which affect their life may be mentioned:

1. Tightness and holding power of tubes in tube sheet.
2. Provisions for differential thermal expansions.
3. Provisions for eliminating or reducing turbulence in the water, especially at the inlet end of the tubes.
4. Temper or hardness of tubes.

In the desire to have each tube tight under the hydraulic test, the tubes often are "over-expanded" in the tube sheet. Since the metal on expanding or rolling is elongated mainly in a circumferential direction and is reduced in thickness, over-expanding causes the expanded portion of the tube to corrugate and leaks may follow. The severe localized distortion due to over-expansion may leave unrelieved stresses which in time may cause failure by season cracking. "Flaking" of the inside of the expanded section of the tube is probably caused by the expander rollers sliding instead of rolling over the tube surface due to improper lubrication of the expanding tools or to worn rollers and mandrel. The tightness and holding power of the tubes are materially affected by the design of the sheet.

Where an expansion joint has been provided between the shell and one tube sheet, both ends of the tubes are rigidly attached to each tube sheet. Where no such expansion joints exist, provisions for differential expansions must be made at the discharge end of the tubes, the inlet end being held rigid. In short condensers and exchangers, it is not generally necessary to provide for differential expansion.

All condenser and exchanger cooling water contains air and other gases in solution and may contain entrapped bubbles of air due to leaks in the line. If turbulence in the water is induced by some obstruction to the flow or by other means, some of the air and other gases are released from solution and frequently cause inlet-end corrosion of the tubes.

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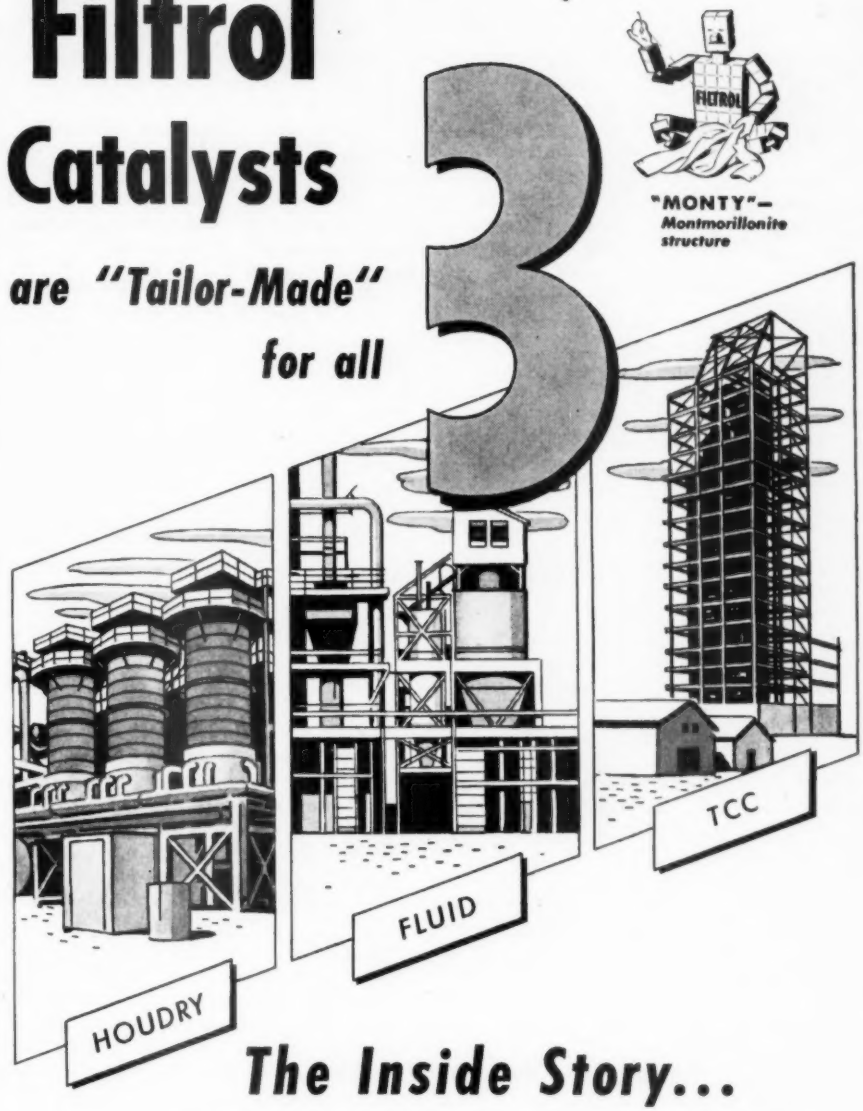

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Protruding ferrules at the inlet end should be regarded with suspicion in this respect. If there is a contraction of the stream of water at the inlet end, corrosion at this point may be expected. A liberal bellmouth will eliminate trouble from this source. Turbulence in the inlet waterbox will release some of the air, causing inlet-end corrosion; correction of this condition frequently is beyond the control of designer because of space limitations.

Standard practice is to supply brass, aluminum bronze, and copper-nickel tubes sufficiently annealed for complete recrystallization but with a fairly small and uniform grain size so that tubes are not too soft. Thus, end-annealing before rolling into the sheet is not generally necessary. Copper tubes are usually furnished hard drawn with annealed ends to prevent splitting during rolling, but also are furnished moderately hard drawn without end-annealing.

Protruding ferrules at the inlet end in packed-type sheets are not recommended because they disturb water flow, cause turbulence, and permit trash to accumulate around them. The gap between the ferrule and tube end increases turbulence. To correct this, flush-type ferrules with a generous bellmouth are recommended. The tube ends butt against the shoulder of the ferrule, permitting full, uninterrupted flow of water. It is necessary to provide sufficient packing to permit a firm grip on the tube, which will prevent the tube pulling away at the inlet end.

If an expansion joint has been provided between a tube sheet and the shell, discharge ends of the tubes can be rigidly held in the tube sheet. They should butt tightly against the shoulder of the snugly drawnup ferrule, and the tubes should receive a slight expanding rolling. Where no provision for expansion has been made, the packing must hold the tube only tight enough to prevent leaking and yet permit sliding. There must be sufficient clearance between the tube end and shoulder of ferrule to allow for expansion. Frequently packed tubes without ferrules are installed. This type should be used only on the discharge ends of the tubes as bellmouth inlet ends are not practical with this type of packing.

The inlet ends of expanded tubes must be held firmly and rigidly in the tube sheet. If no expansion joint has been provided, the discharge ends are installed with a packed joint, a combination fibre and metallic packing being generally preferred. If there is an expansion joint, tubes can be expanded at both ends. Expanding tubes in smooth holes is not recommended as there is no assurance tubes will be tight when installed, nor that the tubes stay tight, vibration soon destroying grip between the tube sheets and tubes. Overexpansion merely accentuates the troubles. Packing without ferrules also may not stay tight in smooth holes.

Holes for tubes should be drilled and reamed 0.007 to 0.010 in. larger than outside tube diameter. Inside end of holes should be chamfered 1/16 in. by 45°. Holes should be serrated with three full turns 0.05 in. wide by 0.007 in. deep, V-thread serrations being preferred by some. Serrations should be approximately midway between chamfer and the bell.

Expanding Discharge Ends of Tubes

After the tubes are inserted and approximately located, expanding operations begin on the discharge end in the case of tubes expanded on both ends. The ends of the tubes are accurately located 5/32 to 3/16 in. from the outside face of the tube sheet. The tube ends are given a slight "set" against the sheet by forcing a plug radially against the tube to prevent rotation and pulling out of the tubes on expanding. Diameter of the plug should be about ⅛ in. less than the internal diameter of the tube; a collar or stop in the plug bearing against the tube sheet face will prevent plug from entering too far and forming a bulge on the tube beyond the sheet. On soft tubes the set can be performed by hand, but on harder tubes 3 or 4 light blows with a hammer will do the job. Tube ends then are expanded using slow-speed self-feeding reversing motor-driven expanders. Tapered rollers are required in order to get cylindrical uniform expansion for the full length expanded, and they should have a long, tapered chamfer so that no sharp contraction takes place or a ridge is thrown up at the end of the expanded portion. Tube should not be expanded into the chamfer of the tube sheet or beyond inside face of the tube sheet. Several other cautions should be observed: Under-expansion is the lesser of two evils; expander should be kept clean and well-lubricated; worn rollers and mandrels should never be used; expander should be selected for diameter and gauge of tubes to be expanded.

Expanding and Belling Inlet End of Tubes

Due to irregularities in lengths of tubes, in the tube sheet itself, and uneven pull-out, the inlet ends of the tubes will protrude unevenly beyond the inlet tube sheet face. This must be taken into consideration when making up the plug for the initial setting of the tubes and for clearance on the expander collar. The tube ends are given an initial "set" as in the case of the discharge ends, care being taken that the tubes are not bulged into or beyond the chamfer on the inside tube sheet face. The expanding operation, preferably by "feel," follows, observing same precautions described for the discharge end. The recess on the collar should be long enough to allow the collar to ride against the tube sheet and also to allow ⅛ in. for "pull-out" due to elongation of the tubes.

The tube ends now protrude beyond the face of the tube sheet by varying amounts and if belled in this condition the bell diameters will vary over quite large ranges. Not only will this be unsightly but there also is danger of splitting the tubes on excessively large diameter bells. In practice, a bell 25 to 30% greater than the tube diameter should not be exceeded. In order to insure a uniform diameter of bell, the protruding ends must be cut back to the correct length. The ends should be well-rounded inside and out, a semicircular section being desirable. Avoid tool chatter marks on the ends of the tubes. The cutting off and rounding can be done in one operation. Next to excessive bell diameters, improperly burred or rounded ends are the greatest cause of split bell ends. The belling operation is performed by a belling plug having a loosely fitting pilot plug. A light air hammer should be used and very light blows struck. Some operators rotate the air hammers through a small circle while belling, decreasing this circle as the operation reaches completion, and winding up with the plug shoulder bearing all over the belled end of the tube.

Since some condenser tube materials are susceptible to season cracking if worked, expanded or belled in one direction only, it is advisable to give the flanged bell a slight reduction in thickness as the belling-plug operation is completed. The amount of this reduction depends on the thickness of tube wall, the clearance of the tube in the tube sheet before expanding and the chamfer of the bell; this is accomplished by properly shaping the belling-plug. For average conditions and 25% bell, reducing the thickness of edge of bell to 70% of the original tube wall is ample. Polished belling-plugs will be found desirable and a light lubricant is desirable.

Cutting and Removing Old Tubes

Care in cutting and removing old tubes will add to their salvage value or, if only localized defects are present, the defective area can be removed and the tubing used in shorter condensers or exchangers. Devices are available which contain a rotary cutter to be inserted into the tube for cutting at any desired point. Time per tube is only a few seconds, so that a single operator can cut hundreds of tubes in a relatively short time.

A mechanical tube puller is available which will loosen tube and packing simultaneously with less than a foot of tube travel, whereas ordinarily the tube will not pull easily until the packing is loose—a travel of sometimes 10 to 15 feet. The puller has 4 concentric teeth which engage the tube internally (and packing if desired), withdraws the tube a few inches, and disengages the drawing tool in one operation. One to two operators are required to handle the machine, and, under good conditions, can loosen 15 to 25 tubes per minute.

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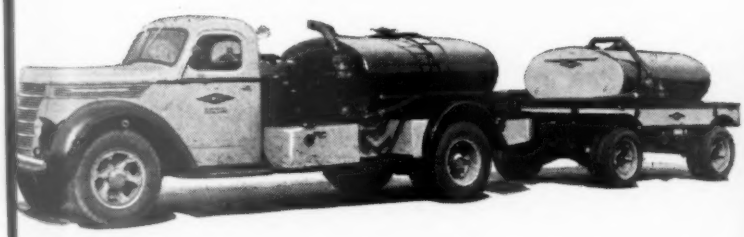

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An efficient process has been developed through the semipilot plant stage for catalytic desulfurization of gasoline fractions containing as high as 3-4% by weight of sulfur in the form of organic sulfur compounds. The process is equally applicable to straight-run or to cracked stocks. Thiophenes, as well as thiophanes, thioethers, and mercaptans are decomposed to hydrogen sulfide and hydrocarbons. Products containing less than 0.01% sulfur may be obtained.

The catalyst employed consists of cobalt molybdate, either as such or deposited on a carrier. In excess of 1500 liquid volumes of feed have been desulfurized by one volume of catalyst without regeneration and without detectable loss in activity. The catalyst can be regenerated repeatedly in the conventional manner to its original activity.

By A. C. Byrns***, W. E. Bradley** and M. W. Lee**

ALMOST from the inception of the petroleum industry the refiner has been faced with the problem of treating distillates either to remove sulfur compounds or to convert them into a more desirable form. For many years the latter procedure was followed wherever possible and gave rise to such well known processes as doctor treatment (1), lead sulfide treatment (1), copper sweetening (2), etc., which convert mercaptans into the less objectionable disulfides. Where stocks of moderately high sulfur content have been encountered, conventional treatment with sulfuric acid has been resorted to in order to obtain products of 0.10 to 0.25% sulfur content.

Recently, however, data have been published (3) indicating that as the sulfur content of a gasoline is progressively decreased to a value of about 0.05%, depending upon the character of the particular stock, there is a more or less gradual increase in lead susceptibility. As the sulfur content is decreased still further, there is a relatively rapid increase in lead susceptibility which becomes quite marked in the region of 0.01% sulfur. This information, which has been confirmed in the present investigation, suggests that at least in the case of gasolines to be blended with lead tetraethyl, it is desirable to reduce the sulfur content to a value of 0.01% or less, the added cost of such treatment being at least partially offset by the decreased amount of lead tetraethyl required to obtain any given octane rating.

A cursory review of literature, including published patents, reveals that in spite of the rather large amount of prior art disclosed on desulfurization, there appears to be little actual data available to indicate the results which may be expected with various types of relatively high sulfur content stocks under different operating conditions. In a general way, previous methods for removing organically combined sulfur from hydrocarbon fractions may be roughly divided into three groups:

The first comprises those processes which depend upon the selective action of sulfuric acid or of a solvent to remove the undesirable sulfur compounds. In the case of stocks of relatively low sulfur content, sulfuric acid treatment can be and is employed. However, with many distillates of relatively high sulfur content, desulfurization with sulfuric acid is accompanied by such high losses of desirable products that treatment is not ordinarily commercially feasible. Recently a number of processes designed primarily for the removal of mercaptans from gasoline distillates and employing a solvent have been developed and are exemplified by the well known Shell Solutizer (4) and Atlantic Unisol (5) processes.

The second group of processes includes those in which the sulfur compounds are decomposed in the presence of a metal or metal oxide and in the absence of hydrogen, to form either hydrogen sulfide or a metallic sulfide and, presumably, hydrocarbons. Probably the best known is the Phillips high-temperature Bauxite treatment (6) which has been used for the decomposition of mercaptans and alkyl sulfides and disulfides in gasoline distillates.

The third group comprises those processes which are more truly catalytic in nature and involve the treatment of hydrocarbon fractions at elevated temperatures and pressures with hydrogen in the presence of a catalyst, thereby causing the sulfur compounds to be decomposed into hydrogen sulfide and hydrocarbons. According to patent literature it is claimed that these processes are capable of decomposing all types of sulfur compounds and the catalysts most frequently mentioned are various thiomolybdates and thiotungstates. Usually, however, desulfurization has been only incidental to more profound changes such as are encountered in cracking-hydrogenation and dehydrogenation. The so-called Hydroforming process (7) which has recently been put into operation in a number of refineries in the U.S. is probably the best example of this type of operation.

Since there appeared to be no method available for effecting the selective decomposition of all types of sulfur compounds without at the same time causing rather profound changes in the characteristics of the hydrocarbons also present, this investigation was undertaken with the principal object of developing such a process.

Preliminary Investigational Work
Effect of Hydrogen

Initially, several experiments were conducted in which vaporized Santa Maria Valley viscosity reduction pressure distillate, containing 3.0% by weight sulfur and described more fully below, was passed over various metals and metal oxides in the absence of hydrogen. These experiments, which were conducted at a temperature of approximately 800°F. and atmospheric pressure, were primarily for the purpose of ascertaining what sulfur reduction could be expected by means of processes of the type belonging to Group 2, mentioned previously.

The data presented graphically in

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*Presented before Division of Petroleum Chemistry, American Chemical Society, Detroit, April 15, 1943.

**Union Oil Co. of California, Wilmington, Cal.

***Present address, Henry J. Kaiser, Development & Engineering Division, Oakland, Cal.

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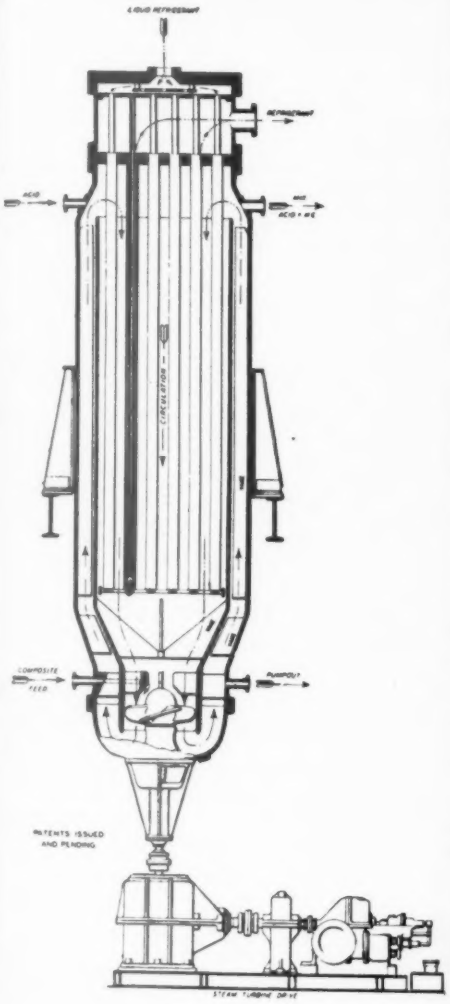

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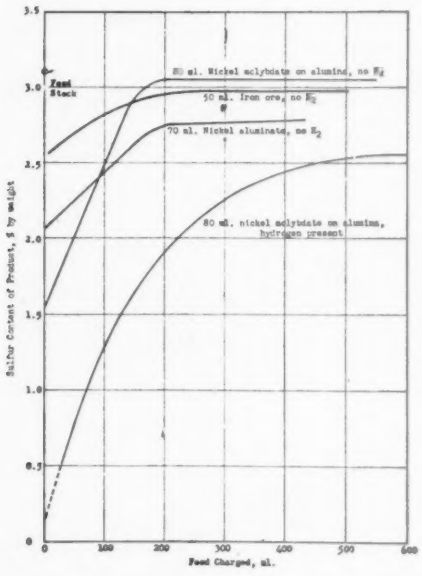
Feed Stock
80 ml. Nickel molybdate on alumina, no H_2
50 ml. Iron ore, no H_2
70 ml. Nickel aluminate, no H_2
80 ml. nickel molybdate on alumina, hydrogen present
Sulfur Content of Product, % by weight
Feed Charged, ml.

Fig. 1—Desulfurization of Santa Maria Valley viscosity reduction pressure distillate at 800° F. and atmospheric pressure in the presence and absence of hydrogen

Fig. 1, and which show the sulfur content of the material being produced after the indicated amount of feed had passed through the reaction zone, are typical of the results obtained. It will be noted that even when nickel, which is known to have a marked affinity for sulfur, was employed, the sulfur reduction during the period of greatest catalytic activity was only nominal and the thiophene compounds were apparently unaffected. Furthermore, the activity of the catalysts rapidly declined to a point where little or no sulfur was being removed. The results of these experiments confirmed the conclusions drawn from published data.

As previously mentioned, it was surmised that a more promising line of investigation was presented by the possibility of selectively decomposing sulfur compounds in the presence of hydrogen and an appropriate catalyst. In order to demonstrate this contention, two runs were conducted at a temperature of 800°F. and atmospheric pressure, using as a catalyst a nickel molybdate supported on alumina, with all factors maintained constant except that hydrogen was introduced along with the feed stock at a rate of 1250 cu. ft. per bbl. of liquid feed in one run, whereas no hydrogen was employed in the other. A comparison of the data presented graphically in Fig. 1 indicates the marked effect of hydrogen, a sulfur reduction from 3.0% to 0.54% being obtained in the presence of hydrogen, while reduction in the absence of hydrogen was only to 1.99%, the comparison being made over the periods of greatest catalytic activity.

It is of particular interest to note that in the run where the vaporized feed was admixed with hydrogen and then passed through the catalyst bed, there was an initial period in which no hydrogen sulfide was present in the exit gases, the catalyst presumably undergoing partial conversion to sulfide. Subsequent to this period there was a copious evolution of hydrogen sulfide and a more or less constant degree of sulfur reduction. On the other hand, in the run where no hydrogen was employed, no hydrogen sulfide was evolved and the sulfur content of the product rapidly approached that of the feed stock as the catalyst lost activity. In both runs the volume of product recovered amounted to 99% of that introduced as feed. These experiments indicated definitely that in the presence of hydrogen, organic sulfur compounds, including thiophenes, can be catalytically decomposed more or less selectively.

Description of Equipment and Operating Procedure

On the basis of the foregoing experiments and a consideration of the various aspects of catalytic processes as described in available published articles, it was concluded that continuous vapor phase treatment in the presence of hydrogen would be the most feasible process, commercially, for the catalytic desulfurization of gasoline fractions. Fig. 11 presents a schematic diagram of the equipment used in the further study of this problem, this unit being constructed in conformity with the above decision.

With the exception of a few preliminary experiments, the following typical procedure was employed for atmospheric pressure operation: Approximately 100 ml. of catalyst was introduced into the catalyst chamber and the latter was brought to reaction temperature, usually 650°F. or higher, over an interval of approximately 3 hours, hydrogen being passed through the catalyst bed during the entire period. When the catalyst section reached a temperature of approximately 400°F., feed stock admixed with hydrogen was introduced into the vaporizing section, maintained at a temperature of approximately 400°F., and the vaporized material passed through the clay pretreating section, likewise maintained at a temperature of approximately 400°F., and then introduced into the catalyst section.

The material leaving the catalyst chamber entered an air condenser and the condensate was collected in a receiver. The uncondensed gases were passed through a trap immersed in a mixture of kerosene and solid carbon dioxide in order to remove any condensable hydrocarbons present. At appropriate intervals the materials collected in the receiver and the trap were removed from the unit, washed with caustic solution, and subjected to analytical tests. It should be noted that some weathering of samples always occurred, and as a result any small amounts of lower boiling hydrocarbons formed were largely lost prior to testing of the products.

In later experiments where operating pressures as high as 250 lbs. per sq. in., gage, were employed, a similar procedure was followed, except that the temperatures of the vaporizing and clay pretreating sections as well as that of the reactor at the time of feed introduction were higher in order to prevent condensation, and the hydrogen flow rate was estimated by metering the exit gases at atmospheric pressure.

Experimental work indicated that in the case of most of the compounds considered, 650°F. represented a rather critical temperature. If the catalyst temperature was decreased much below this figure there was a rapid decline in activity with a resultant decrease in the

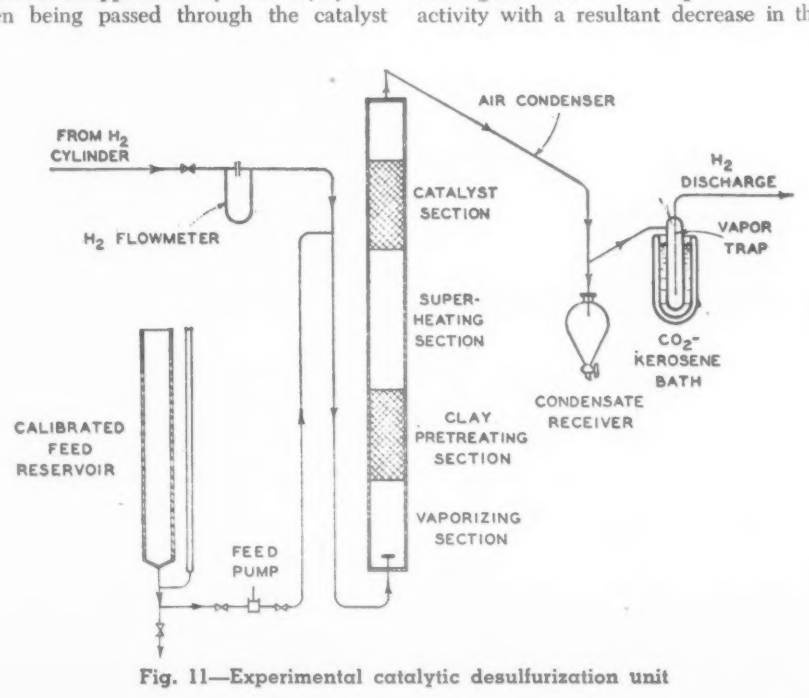

Fig. 11—Experimental catalytic desulfurization unit

5 Talking Points

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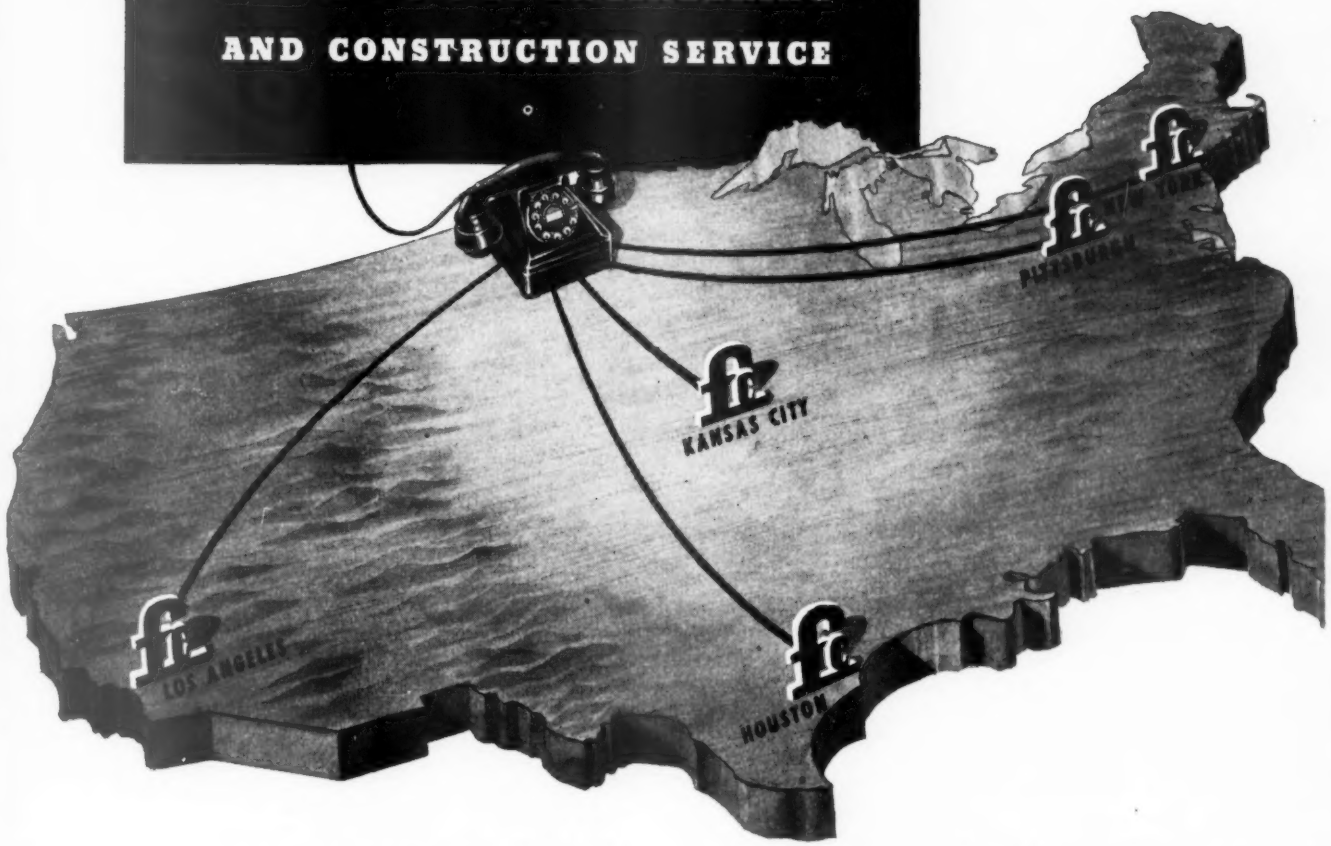

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degree of desulfurization. A more or less constant desulfurization activity was exhibited at temperatures between 650° and 800°F. with little or no evidence of hydrocarbon decomposition. However, catalyst activity was maintained over a much longer interval at 650° to 700°F. than at more elevated temperatures, and 650°F. was selected, therefore, as the operating temperature for comparing various catalysts. Furthermore, in order to magnify differences in activities of various catalytic materials, a high sulfur content stock, Santa Maria Valley viscosity reduction pressure distillate, was employed, and the experiments were conducted at atmospheric pressure.

Vapor phase clay pretreatment of the stock was instituted primarily as a means of insuring the removal from the vapors of readily polymerizable materials which might deposit on the catalyst and lead to coke formation with a resultant decrease in catalyst activity. Subsequent experimental work disclosed that by employing a relatively large vaporizing section maintained at a temperature in the neighborhood of 600°F., small amounts of reactive materials were immediately removed as a coke-like deposit, thereby obviating the necessity for clay treatment. As a consequence, vapor phase clay treatment was employed in most of the earlier experiments using Santa Maria Valley distillates and was eliminated in favor of an enlarged vaporizing section during later work with San Joaquin Valley pressure distillate as feed stock.

Initially, the particular feed stock chosen for study was pressure distillate derived from the viscosity reduction of Santa Maria Valley residuum. This material was believed to present a particularly difficult treating problem because of the fact that the major portion of the sulfur is present in the form of the difficultly-removable thiophene-type compounds. The following data give an indication of the distribution of sulfur among the various types of sulfur compounds present in a 200° to 300°F. fraction of the above-mentioned distillate:

Form in Which S is Present	Actual S Present, Per Cent by Wt.
Mercaptans	0.206
Disulfides	0.004
Sulfides	0.6
Thiophenes	2.19
Total	3.00

Subsequent experimental work disclosed that the 200° to 400°F. fraction of pressure distillate, derived from thermal cracking of San Joaquin Valley naphthenic crude oil and containing 0.7% sulfur, was equally as difficult to desulfurize as Santa Maria Valley cracked distillate. Since this material was more readily available, the latter part of the investigation utilized this stock almost exclusively.

In the case of both of the above-mentioned stocks, the fraction boiling below 200°F. was eliminated from consideration, primarily because such a procedure minimized vaporization losses, and facilitated experimental work. Furthermore, an analysis of the material boiling below 200°F. disclosed that the sulfur present was principally in the form of the more readily removable mercaptans.

Early in the investigation, it was observed that the feed pump introducing the Santa Maria Valley stock into the vaporizing section was operating more and more erratically with each successive run. This trouble was not encountered when freshly distilled pressure distillate was employed, but was only noted when using stock which had stood for several days after fractionation. The difficulty was traced to the presence in the aged distillate of an excessive amount of gum which was separating as a solid precipitate and coating the pump check valves. In order to determine the effect on sulfur reduction of various types of stock pretreatment to remove gums, a series of experiments was conducted with the following feed stocks:

1. Aged pressure distillate.
2. Liquid phase zinc chloride-treated aged pressure distillate.
3. Freshly distilled pressure distillate.
4. Liquid phase zinc chloride-treated and freshly distilled pressure distillate.

These experiments, although not of sufficient duration to determine the effect on catalyst life, indicated that stock pretreatment of the type used had little or no effect on the degree of sulfur reduction. As a consequence of this conclusion and in order to minimize

Table 1—The Characteristics of Various Feed Stocks Which Have Been Treated by the Cobalt Molybdate Desulfurization Process and of the Resultant Products

	San Joaquin Valley Pressure Distillate			Santa Maria Valley Viscosity Reduction Pressure Distillate		Aromatic Gasoline Extract	
	Feed Stock	Product A	Product B	Feed Stock	Product	Feed Stock	Product
Operating Conditions							
Catalyst Temperature, °F.	...	750	850	...	800	...	725
Reactor Pressure, lb./sq.in., gage	...	250	150	...	200	...	100
H_2 Flow Rate, Mcf/bbl. of feed*	...	5.1	5.1	...	3.4	...	3.0
Feed Rate, vol./vol. of cat./hr.	...	2	1.3	...	1.1	...	1.0
Catalyst	...	Pelleted Cobalt Molybdate	Pelleted Cobalt Molybdate	...	30% $CoMoO_4$ 70% Al_2O_3	...	Granular Cobalt Molybdate
Feed and Product Characteristics							
Product Recovery, % of feed volume		100	96		97		98
Gravity, °API at 60° F.	46.2	49.2	47.7	49.1	56.4	35.5	35.6
Engler Distillation Temperature, °F.							
Initial	192	180	185	190	...	284	280
10%	243	230	242	232	...	294	293
50%	303	294	303	275	...	305	305
90%	377	375	383	325	...	337	336
Max.	403	406	446	352	...	369	365
Sulfur Content, % by wt.§	0.63†	0.018	0.000	3.0†	0.01	0.018	0.001
Copper Dish Gum Content, mg./100 ml.	915	20	7	...	...	...	...
Color	Brown	Water White	Water White	Yellow	Water White	Water White	Water White
Knock Rating, CFR Motor Method							
Clear	73	59	62	70	60.5	...	...
3.0 ml. Tetraethyl Lead/gallon	79	80	84	75	80.0	...	...
Lead Susceptibility Slope	0.55	2.05	2.40	0.49	1.90	...	...
Solubility in 99% H_2SO_4, % by vol.	35	14	21	33	10	71.2	71.7
Olefins by Bromide-Bromate, % by vol.	49‡	2	7	‡	...	0.2	0.4
Aromatics (Acid Solubility—Olefins) % by vol.	...	12	14	...	...	71.0	71.3**

*Measured at atmospheric pressure.

†The sulfur compounds present were substantially all thiophenes.

‡This test is reliable only in the case of low sulfur content products and gives high values where relatively large amounts of sulfur compounds are present.

§Determined by Ethyl lamp method.

**Approximately 85 per cent of the phenolic compounds present in the feed stock were destroyed during treatment.

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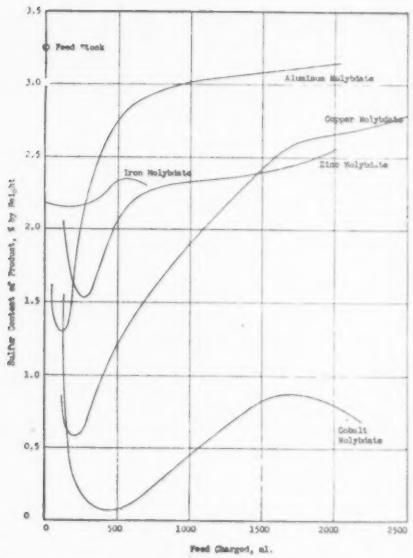

Fig. 2—Desulfurization of Santa Maria Valley viscosity reduction pressure distillate by 100 ml. of various molybdates at 650° F. and atmospheric pressure in the presence of hydrogen

experimental difficulties, most of the runs employing Santa Maria Valley stock were conducted with a 200° to 300°F. fraction which had been zinc chloride-treated and freshly distilled prior to introduction into the treating system. In later work with San Joaquin Valley cracked distillate, zinc chloride treatment was dispensed with as it was possible to maintain a supply of reasonably fresh stock, thereby obviating the need for such a procedure.

Description of Tabulated Data and Graphs

Particular attention should be called to the character of the various graphs which show sulfur content of the product being produced at any instant expressed as a function of the total volume of feed passed over the catalyst up to the particular point under consideration. It will be noted that in nearly every case there was an initial rapid increase in activity to a point at which maximum desulfurization was obtained, followed subsequently by a more or less rapid decrease in activity to a point of relatively constant desulfurization. At the present time the causes for the observed variations in activity are not definitely known.

It is probable that a major part of the initial increase in the amount of desulfurization can be attributed to the increase in temperature of the catalyst bed from the point at which feed introduction was started to the final operating temperature of 650°F. or higher. Hydrogen sulfide may be intimately associated with the decline in activity to the "steady state", since the latter occurs coincidentally with the appearance of this material in the vapors issuing from the catalyst chamber. It is possible that the initial period of high activity is realized because of a relatively low partial pressure of hydrogen sulfide, since the latter is either not formed, the sulfur compounds reacting directly with the catalyst to form a metallic sulfide, or, what is more likely in view of the influence of hydrogen, the hydrogen sulfide is formed and is immediately removed by reaction with the catalyst.

In any event, the final period of relatively constant desulfurization apparently represents an equilibrium condition, with the catalyst partly in the form of metallic sulfide, and deviations from this condition occur only slowly as coke-like material becomes deposited on the catalyst. This latter period is believed to be the best measure of the relative activities of various catalytic materials, provided, of course, that desulfurization is the sole aim of the treatment without regard to the other characteristics of the gasoline.

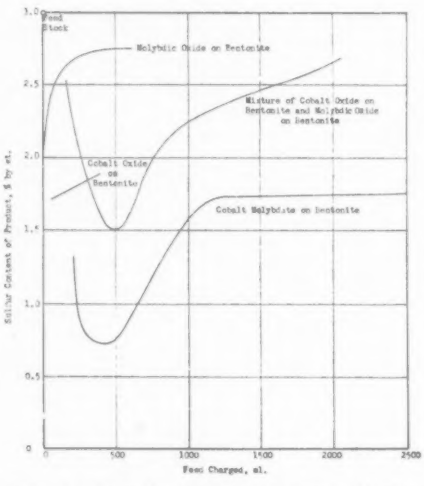
Feed Stock
Molybdic Oxide on Bentonite
Mixture of Cobalt Oxide on Bentonite and Molybdic Oxide on Bentonite
Cobalt Oxide on Bentonite
Cobalt Molybdate on Bentonite
Sulfur Content of Product, % by wt.
Feed Charged, ml.

Fig. 3—Desulfurization of Santa Maria Valley viscosity reduction pressure distillate at 650° F. and atmospheric pressure in the presence of hydrogen, using 100 ml. of cobalt oxide, molybdic oxide, and cobalt molybdate catalysts supported on bentonite

Detailed Description of the Selection of Active Desulfurization Catalysts

As mentioned previously, various molybdenum compounds have reportedly been used as cracking-hydrogenation catalysts, and therefore it was decided to center the initial investigational work to a large extent on a study of such compounds as possible selective desulfurization catalysts. A number of materials exhibited definite catalytic activity of the desired type and the data obtained in testing the more active substances are presented graphically in Fig. 2. The experiments were conducted at atmospheric pressure in accordance with the details previously described and using Santa Maria Valley viscosity reduction pressure distillate as feed stock.

A study of Fig. 2 discloses that of the various materials considered, cobalt molybdate is by far the most active, both as regards the initial period of high activity and the subsequent period of relatively constant desulfurization. This compound was therefore selected for further study.

Cobalt molybdate may be considered to be a chemical union of cobalt oxide and molybdic oxide, CoO.MoO3. In order to demonstrate that the high activity of this compound is due to an actual chemical combination of these oxides with a resultant alteration of the spacing of the various atoms in the crystal lattice, 4 experiments were conducted in which cobalt oxide, molybdenum trioxide, a mechanical mixture of these two oxides and cobalt molybdate, respectively, all impregnated in bentonite as a support, were employed as catalysts under the conditions already described for atmospheric pressure operation and using Santa Maria Valley pressure distillate as feed stock. A comparison of the results obtained in these experiments and presented graphically in Fig. 3 reveals that neither oxide alone nor in mechanical admixture approaches the activity of the chemical combination.

Effect of Hydrogen/Feed Stock Ratio and Operating Pressure on Catalyst Life and Product Sulfur Content

In the experimental work leading to the development of active catalytic materials and described in the foregoing sections, a more or less arbitrary set of reaction conditions was employed in obtaining a comparative measure of the efficiencies of various catalysts. The subsequent experimental work, described in the following sections, was concerned with a determination of the important operating variables and their effect on catalyst life and desulfurization. It appeared reasonable to suppose that approximately the same results would be obtained in greater or less degree with various catalysts of similar activity, and, therefore, pelleted cobalt molybdate

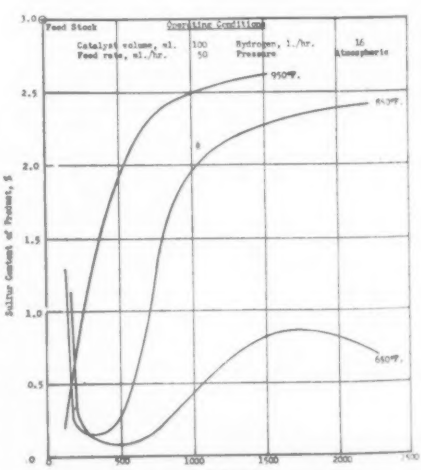

Fig. 4—Effect of variations in operating temperatures on the desulfurization of S. M. V. viscosity reduction pressure distillate using cobalt molybdate

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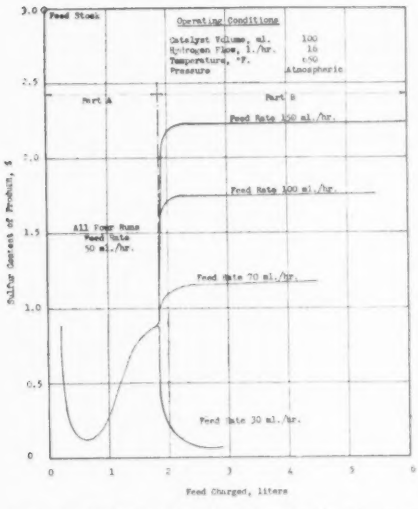

Fig. 5—Effect of variations in feed rate on the desulfurization of S. M. V. viscosity reduction pressure distillate using cobalt molybdate

was selected for this study since it could be readily prepared.

Initially, a series of comparable experiments was conducted in which reaction temperatures of 650°, 850° and 950°F. were employed, all other factors being maintained constant. The results of these experiments presented graphically in Fig. 4, show that when operating at atmospheric pressure, catalyst activity declines rapidly when operating at temperatures in the neighborhood of 850°F. and higher.

Two other series of runs were conducted at atmospheric pressure, one in which the feed rate was varied and the other the hydrogen rate, all other factors being maintained constant. The data for these experiments, conducted at 650°F. are presented in Figs. 5 and 6, respectively. Fig. 7 shows graphically the sulfur content of the various "steady state" products from these two series of experiments expressed as a function of the mol fraction of hydrogen in the reaction chamber vapors, and as a function of the calculated time of contact. From the information presented in this latter figure, it is readily seen that when desulfurization alone is the sole aim without regard to the other characteristics of the gasoline, the partial pressure of hydrogen in the reaction zone more or less directly controls the sulfur content of the product while the time of contact is of secondary importance.

The above results suggest that operation at hydrogen pressures above atmospheric would increase the amount of desulfurization obtained with a given weight of catalyst, and this conclusion is confirmed by the results of Runs 20 and 21 shown graphically in Fig. 8. In the latter run, conducted at pressures of 40 lbs. and 200 lbs. per sq. in., gage, and a feed rate equivalent to one volume of liquid stock per volume of catalyst per hour, a greater amount of desulfurization was obtained than in Run 20 conducted at atmospheric pressure and a feed rate of only 0.5 volumes of feed per volume of catalyst per hour.

Regeneration and Prolonged Usage of Cobalt Molybdate Catalysts

Aside from initial activity, the value of any catalyst is primarily determined by two factors: namely, the ease with which the initial activity can be restored after it has declined during use, and the number of times such regeneration can be accomplished before it is necessary to discard the catalyst. In order to evaluate these factors, pelleted cobalt molybdate and cobalt molybdate supported on alumina were selected for test.

In processes of the type under consideration it has been generally recognized that the decline in catalyst activity with use is due to the deposition of coke-like materials in the catalyst structure. As a consequence, regeneration is usually accomplished readily by controlled oxidation to remove the carbon. Simultaneously, any metallic sulfide present in the catalyst is converted to oxide. Since these reactions generate a considerable amount of heat, particular care must be exercised in order to avoid local overheating of the catalyst which would lead to shattering, sintering, or other deleterious changes in physical structure.

With the above considerations in mind a number of regeneration procedures were tested, and the following one adopted for both catalysts since it apparently restored them to their original activity: Initially, nitrogen was passed through the catalyst bed while the latter was maintained at a temperature of 650° to 700°F. This served to remove any volatile materials present. Subsequently, while still maintaining the catalyst in the above temperature range, the major portion of the carbon present in the catalyst chamber was oxidized by treatment with a mixture of nitrogen and air, the proportion of air being increased

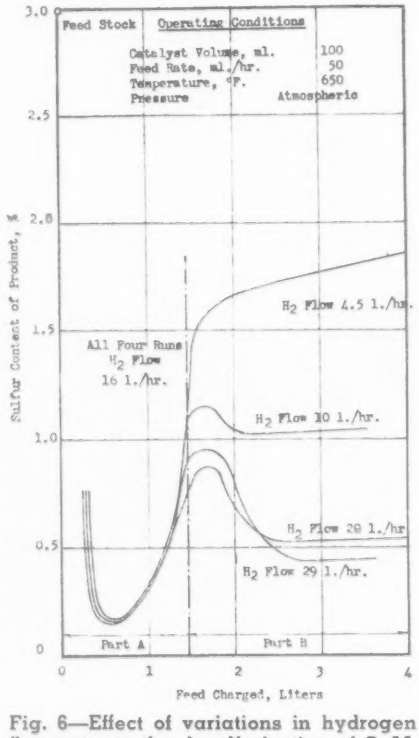

Fig. 6—Effect of variations in hydrogen flow rate on the desulfurization of S. M. V. viscosity reduction pressure distillate using cobalt molybdate

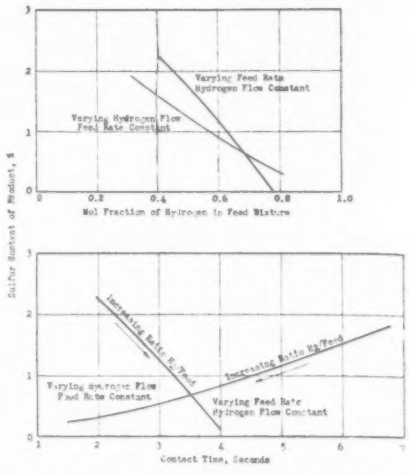
Varying Feed Rate Hydrogen Flow Constant
Varying Hydrogen Flow Feed Rate Constant
Sulfur Content of Product, %
Mol Fraction of Hydrogen in Feed Mixture
Increasing Rate H2/Feed
Varying Hydrogen Flow Feed Rate Constant
Varying Feed Rate Hydrogen Flow Constant
Contact Time, Seconds

Fig. 7—Effect of variations in feed rate and hydrogen flow on the desulfurization of S. M. V. viscosity reduction pressure distillate showing sulfur content of product as a function of the hydrogen partial pressure and of the contact time based on data of Figs. 5 and 6

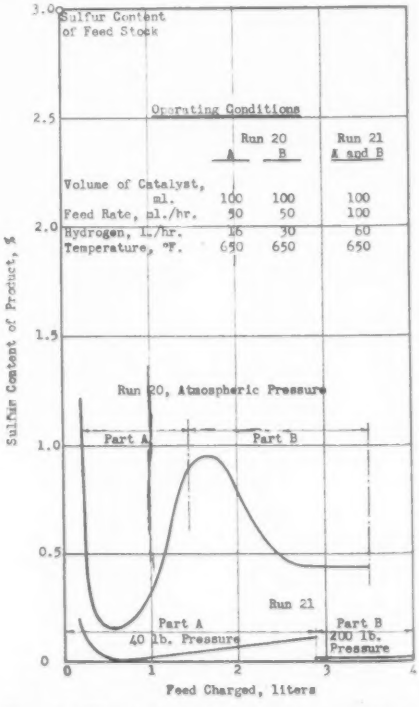

Fig. 8—Effect of variations in operating pressure on the desulfurization of S. M. V. viscosity reduction pressure distillate, using cobalt molybdate

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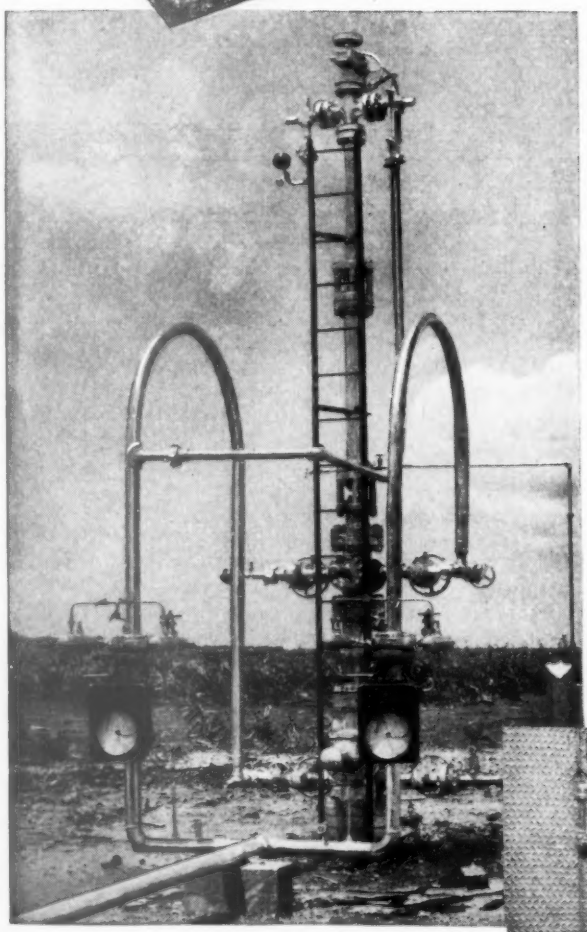

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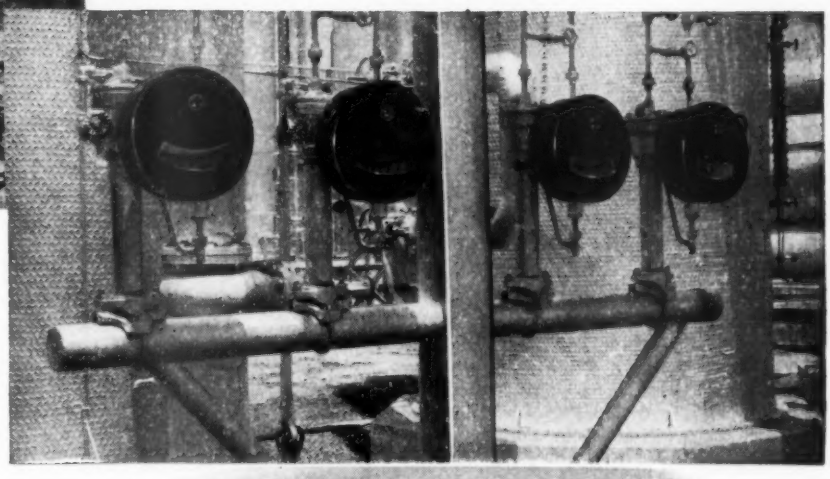

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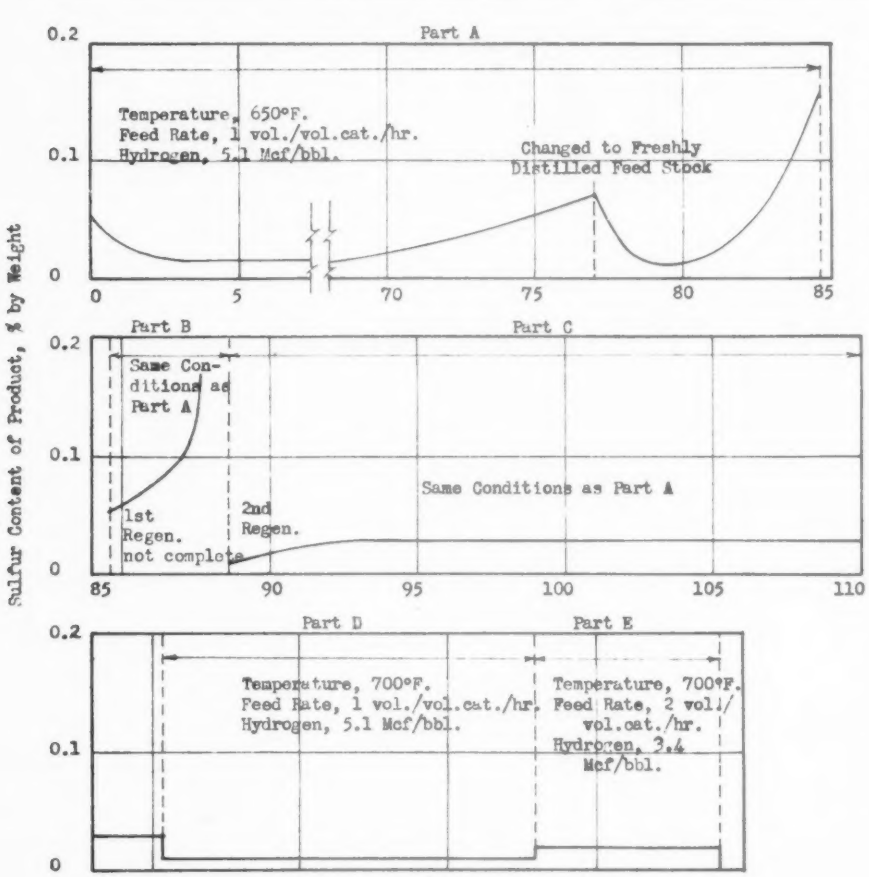

Fig. 9—Run 22. Exhaustion test of 100 ml. of cobalt molybdate-alumina catalyst Feed stock—cracked distillate from San Joaquin Valley crude—0.7% S Operating pressure—250 lb., gage

from about 5% to 100% over a period of 6 to 7 hours.

The remaining carbon was then removed by passing air alone through the catalyst bed while increasing the temperature from 700° to 950°F. over a period of two hours and maintaining the temperature at the latter value for an additional two hours. In one case, as noted below, an attempt was made to regenerate the catalyst by employing a maximum temperature of only 850°F., but the activity was not completely restored. During all of the regenerations some sulfur dioxide was evolved, indicating the reconversion of the cobalt molybdate from a partial sulfide to an oxide.

The approximate useful life between regenerations which can be expected under various operating conditions with cobalt molybdate catalysts, and the effect of repeated regenerations on this life, are illustrated by the runs presented graphically in Figs. 9, 10A and 10B. In the first of these runs, shown in Fig. 9, the cobalt molybdate-alumina catalyst was used, and a set of operating conditions chosen which would give a long catalyst life between regenerations, good desulfurization, and maximum product recovery.

The upper graph of Fig. 9 shows that nearly 85 liters of pressure distillate from San Joaquin Valley crude was treated to an average sulfur content of less than 0.02% by 100 ml. of catalyst (containing only about 25 grams of cobalt molybdate) before a sudden rise in the sulfur content of the product indicated that regeneration was necessary. The hump in the curve after 77 liters of stock had been processed was coincidental with a change to a freshly distilled stock, and it may signify that an even longer catalyst life could have been realized by using freshly distilled stock at all times. The amount of treated material recovered during this run amounted to 99% of the volume of feed stock introduced into the reactor.

As shown in the center graph of Fig. 9, the first regeneration of the catalyst was more or less unsuccessful, probably because a maximum oxidation temperature of only 850°F. was used. The second regeneration restored the catalyst activity practically completely. In the latter part of the run, shown in the lower graph of Fig. 9, the temperature was raised slightly, the feed rate doubled, and the hydrogen to feed ratio reduced. The overall effect was only a slight decrease in the degree of desulfurization.

In examining the products from the various runs with the cobalt molybdate-alumina catalyst it was observed that they all showed a high copper dish gum content, ranging from 160 to 360 mg. per 100 ml. of sample. Products from similar runs using unsupported cobalt molybdate as the catalyst had relatively low copper dish gum contents, usually about 20 mg. per 100 ml. of sample, or lower. Tests revealed that in general the use of supported cobalt molybdate catalysts gave rise to products of relatively high copper dish gum content, but that it was possible to remove these gums by a subsequent vapor phase clay treatment. This treatment was particularly effective at temperatures in the neighborhood of 400°F. and atmospheric pressure. Treatment of the feed before contact with the catalyst was ineffective.

In the second run, shown in Figs. 10A and 10B, 50 ml. of pelleted cobalt molybdate catalyst (78 grams) was used. At 700°F., over 91 liters of stock was treated to an average sulfur content of less than 0.02%, with a product recovery amounting to 99% by volume of the feed. It was then decided that in order to obtain regeneration data in a reasonably short time, it would be advisable to change the operating conditions so as to shorten the cycles between regenerations. The data of Figs. 10A and 10B show the results of operating at 850° and 900°F. with moderately high pressure and hydrogen flow. The catalyst used in this run was subsequently regenerated a total of 11 times, with no evidence of permanent deterioration in activity.

The Effect of the Desulfurization Treatment on Other Characteristics of the Feed Stock

In the foregoing sections, the entire attention has been focused on developing a procedure for selectively removing sulsulfur from gasoline distillates without regard to the effect on other characteristics of the feed stock. However, in normal commercial operations the petroleum refiner in addition to sulfur content is concerned with such factors as product recovery, knock rating, olefin content, aromatic content, changes in Engler distillation temperature, etc. The accompanying tabulation therefore presents detailed information on the properties of a number of different feed stocks and of the products derived therefrom under conditions of treatment which would be employed for maximum desulfurization efficiency and product recovery.

From the above data it may be concluded that under the conditions of operation selected, the olefinic, diolefinic and phenolic compounds are largely hydrogenated while the aromatic hydrocarbons are substantially unaffected. Due to the hydrogenation of the olefinic hydrocarbons, treatment of thermally cracked distillates lowers the clear knock rating. However, due to the increase in lead susceptibility accompanying the reduction in sulfur content, the knock rating of the

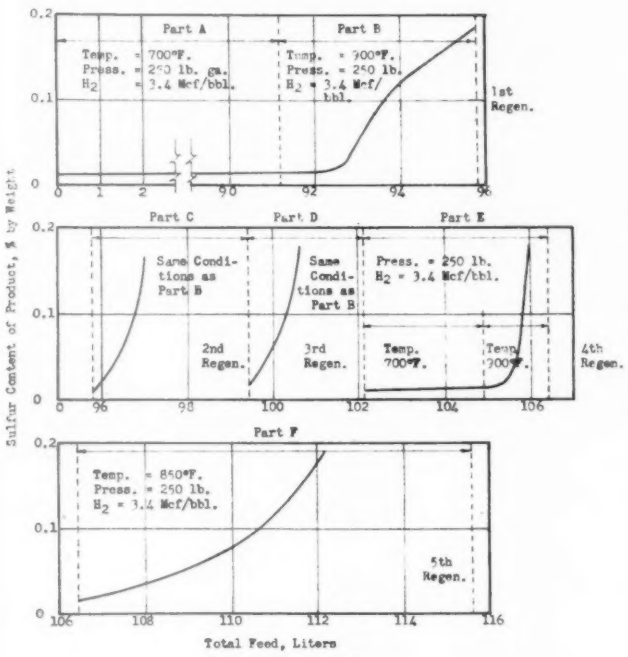

Fig. 10A

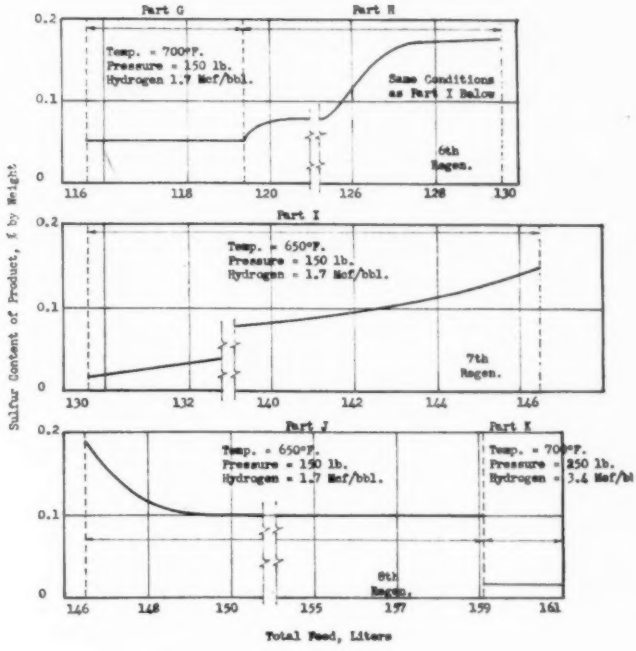

Fig. 10B

Run 23. Exhaustion test of 50 ml. of cobalt molybdate catalyst
Feed stock—cracked distillate from San Joaquin Valley crude—0.7% S
Feed rate—4 vol./vol. cat./hr.

treated material containing 3.0 ml. of tetraethyl lead per gallon is ordinarily higher than that of the original stock containing the same proportion of tetraethyl lead.

In the case of straight-run and catalytically cracked distillates, which normally contain relatively small proportions of olefinic hydrocarbons, the desulfurization treatment is accompanied by only negligible changes in clear octane rating. Products of good color and stability can be readily obtained and, as has been previously indicated, the yield of treated material usually amounts to about 99% by volume of the feed stock.

BIBLIOGRAPHY

(1) V. A. Kalichevsky and B. A. Stagner, Chemical Refining of Petroleum, Revised Edition (Reinhold Publishing Corp., New York, 1942)

(2) M. W. Conn, Refiner, 20 (3), 53, (1941) R. G. Atkinson, National Petroleum News 32 (50), R-450 (1940)

(3) Graves, IEC, 31, 840-56 (1939)

(4) D. L. Yabroff and L. E. Border, Proc. API 20M (III) 95 (1939)

(5) H. W. Field, Oil & Gas Journal, 40 (20) 40 (1941)

(6) Alden and Schulze, Refiner, 18 (11), 96 (1939)

(7) Smith and Moore, Chem. and Met. 48 (4), 77 (1941)

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Every Man His Own Safety Engineer

This Psychological Principle Guides Magnolia Petroleum Co., Winner of '43 Safety Contest, Natural Gasoline Division

By D. P. Thornton, Jr.

DESPITE the handicap of the stress of war days, workers for Magnolia Petroleum Co. put in 554,902 hours in its refineries, gasoline plants and oil field properties without a single injury which required a worker to leave his job. This company had the best record of all oil companies operating natural gasoline plants, in the latest safety contest of the National Safety Council's Petroleum Section.

For the year ending June 30, 1943, the Natural Gasoline Division of the Petroleum Section set an accident frequency rate of only 6.03. This is a 19% decline from its average accident frequency rate for the preceding year. It compares with a rate of 11.72 for the entire oil industry during the year 1942 and an average rate of 14.85 for all industries for the same period. Frequency is defined as the number of reportable injuries per million hours of exposure while on the job.

Magnolia's program is not fundamentally different from many other companies' setups, according to W. I. Kent, head of its accident and fire prevention department. Its safety work is based on purely psychological grounds. Every employe is his own safety engineer, from plant and area superintendents down through department heads, supervisors, foremen and gang pushers to the individual workman. Only four full-time safety men in the field are required to handle all the work outside of the company's main offices in Dallas.

Magnolia's safety program was first organized in 1932, following the increasing accident frequency-rate which the company had been experiencing for some years. When the rate reached approximately a score of fatalities and 1400 disabling accidents out of 12,000 employes, as in 1931, it was evident that something had to be done, and soon. Following the present safety plan's inception in 1932, the accident rate steadily dropped each year, and in the latest year for which company-wide statistics are available, 1942, it amounted only to one fatality and 211 disabling accidents among 11,000 employes.

Four Division Safety Areas

In continuing safety efforts under wartime shortages of many materials, reduced manpower, and increased demands for refined products, the company has faced new problems. Like every other company, skilled employes have been lost to the armed forces and new construction has been carried on under wartime conditions, but the safety record has not suffered. Company officials give two principal reasons: First, any serious shortage of safety supplies, such as shoes, helmets, goggles, protective clothing, and so on, has been avoided, although there is far from a surplus. Second, plant operating equipment has been kept in the best possible condition, through proper maintenance and repairs.

For safety supervision, four areas have been set up by the Magnolia company, three of which correspond in their boundaries to the company's three operating divisions. Oklahoma, Kansas, and the Texas Panhandle area comprise one division, with headquarters at Oklahoma City. West and Southwest Texas form another division, with headquarters at San Antonio. Louisiana, Arkansas, and South Texas form the third division, headquartered at Shreveport. The fourth division supervises exclusively the safety program in all refineries, from headquarters at Beaumont. At each refinery there is a safety director with the necessary helpers who handle the safety work peculiar to that plant. The company's headquarters office at Dallas, in addition to supervising the safety work of all divisions, is in charge of the home office and research laboratories.

Supervisor's Duties

The division safety supervisor's job is to work with all supervisory personnel in his area, inspecting, testing, and suggesting, but never ordering. All concerned understand that the supervisor's work is to help them; he is not there to snoop, interfere, or carry tales. He holds safety meetings with supervisory personnel, and together they work out their problems. During the safety meetings of the employes, always held during his visits, the supervisor attends only as an advisor.

The division safety supervisor schedules his visits to every point of operations within his territory for one year in advance. All the supervisors affected receive a copy of this schedule, as well as the headquarters office in Dallas. This advance scheduling is for two purposes: First, so a regular schedule of calls can be developed for every point in the territory; and second, so the supervisory personnel at all points will know well in advance when to expect the visit and may schedule their work accordingly. This makes for a minimum of interruptions in normal plant operations.

The best way to describe the workings of this oil company's safety program is to follow the procedure in an individual department. Accordingly, the natural gas—gasoline department is taken for an example.

When the safety supervisor arrives at a plant, he first holds a safety meeting with the superintendents and foremen, discussing with them safety problems developed as each man brings forth his complaints, suggestions, and queries. He endeavors to make final decisions right then if at all possible. After the meeting, the safety supervisor inspects any property involved in the discussion, the inspection being aimed to determine first hand any potential hazards, together with the steps to be taken for their elimination. At least one of the supervisory personnel, the su-

Magnolia Petroleum Co. workers learn how to give first aid for fracture of the thigh. This is included in standard first-aid and safety instruction in natural gasoline plants and refineries

perintendent, chief engineer, or foreman, goes along on this tour. The supervisor thus becomes acquainted with the problems peculiar to the plant or property in question, while the foreman or chief engineer learns the practical applications of safety engineering to his individual work. Any recommendations are based on company-wide or industry-wide experience with similar problems—a broader experience than is usually available to the safety director of a single plant.

Meetings are Informal

Later, the foremen of the various operating groups on the property or at the plant call safety meetings of their individual crews at which the safety supervisor sits in an advisory capacity, ready to help but not "stealing the show". One of the group, not necessarily the foreman, leads the discussion, explaining any new accident prevention ideas which may have been developed there or elsewhere and inviting suggestion and comment. The purpose of these meetings is to make each individual realize he is his own safety engineer and what it means to him and his family to maintain safe working conditions and practices. The meetings are strictly informal, with small groups the rule.

To make the men more conscious of safety, the spirit of competition is invoked through an incentive plan. When an individual plant or station works 12 months without any disabling injuries, a certificate of merit is awarded, signed by the company's vice president in charge of operations, the general manager of that department, and the local superintendent. If the department as a whole makes such a record, the department is awarded a similar certificate, signed by the president, vice president, and company general manager. As a result, competition is stiff between departments as well as between plants.

The company officials realize that, in order to get their safety program to work, it must not become onerous to the rank and file of employes, or to their supervisors. No one must feel that all the accident department ever does is harp, harp, harp on safety-this and safety-something-else, that they must "endure" the safety supervisor's visits and give lip-service to his recommendations rather than co-operation.

The division safety supervisor, who is in direct contact with the employes as a whole, is recognized as the key man in the program. In selecting a supervisor much consideration is given to his ability to get along with others. Other qualifications, in recognition of the importance of the psychological factor in safety work, are listed as: Is the individual under consideration sympathetic to and truly interested in the other fellow's problems? Can he see the company-side and the employe-side of a given situation? Does he have adequate working experience in the departments whose safety-work he is to supervise? The individual's actual knowl-

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edge of safety engineering is secondary to these points.

The men selected as safety supervisors come from the ranks where they already are well acquainted with the company, its policies and its basic operations, and safety engineering is the principal new subject they have to learn. The old supervisors look for men in their territories who show aptitude for safety work and who are able to get along with the men they work with or those working under them and keep them in mind for supervisory positions. When a vacancy is about to occur, eligible men in that division are asked to apply if they are interested. The last time a vacancy occurred, there were about 50 applicants.

When final selection is made, the man is sent to Dallas headquarters for about a month and familiarizes himself with the work of the safety department, how accident reports are made, procedure in accident investigation, and details of safety work. Then he is sent into the field in a different division from the one in which he is to work permanently, under the supervision of the head of the department. He makes visits similar to those he will make in his own division, but this time for instruction in putting into practice what he has recently learned in theory. There are two reasons for this procedure: One is that the neophyte learns his work properly from the beginning, and two, he is spared the embarrassment of having to learn his work and make his initial mistakes in the area and under the eyes of the men he must work with later.

After this "shakedown" tour, the neophyte is sent to the division where he will be permanently attached. Even then, he is not immediately left to his own devices but for a time is under the supervision of the head of the department. When Dallas headquarters is sure he is ready for it, he is turned loose on his own.

Watching the Accident-Prone

Statistics indicate there are two classes of employes who are the most likely to be involved in disabling or fatal accidents, the green hand and the old-timer. The green hand is accident-prone because he is not yet sufficiently familiar with the equipment he uses and his duties to be fully aware of all the safe practices necessary and required. Moreover, he usually is trying so hard to please his boss and to create a good impression that he is overzealous in trying to make a good showing. In his efforts he may slight some necessary precaution and be hurt.

On the other hand, the old-timer is likely to become a bit lax in his attention to safety because through the years he has become so familiar with the work and the equipment he may become somewhat contemptuous of the chances for accident. Or, if his work is especially hazardous, he may become so hardened to the continual presence of danger and perhaps the fact he has never yet been hurt that he always believes safety precautions are for the other fellow.

The cure for the two classes of accident-prones are as different as the causes. For the green hand, close supervision and education in his duties constitute the prescription. As soon as he settles down, knows what is to be done, and how to do it, he no longer represents a manpower hazard. Occasionally there is that rare individual who knows it all and will take neither instruction nor advice. Preferably these are not hired, but if they do "slip in", they are transferred to another department. Usually, the "cure" for the old-timer is more simple. He generally gets over his carelessness after a word from his boss, who calls him in and privately directs attention to his laxness with its possible consequences to him and to others. Occasionally here also a man will be found who fails to respond to constant reminders that he is being careless. He may also be transferred to a job with different duties.

When an old employe is transferred to work in another department or another plant, all that is necessary for his safety supervisor is to see to it that the employe is familiarized with the difference in the equipment he will use now over that which he used before and that he learns where lines, valves, pumps, safety and fire-fighting equipment are located.

In the case of a new employe, his supervisor. or, generally, the plant superintendent, calls him into conference as soon as he goes on the payroll. His new duties are explained to him and company policies on various matters including annuity benefits and retirement plans. Then he receives preliminary safety instruction in things to look out for on the job, regardless of his previous experience. He is given a rule book (every employe has one, which he must sign and be responsible for) which contains rules and regulations on both operational and safety matters pertaining to his job. Finally, he is taken on a tour of the place where he is to work, introduced to the men, receives precise instruction in his duties, responsibilities, safety practices for his protection as well as others, and is told how to protect and care for the equipment he works with. In all instructions the motto of the safety-man is emphasized: "If a job is done correctly, it is done safely".

Obviously, the division safety supervisor cannot always be on hand when

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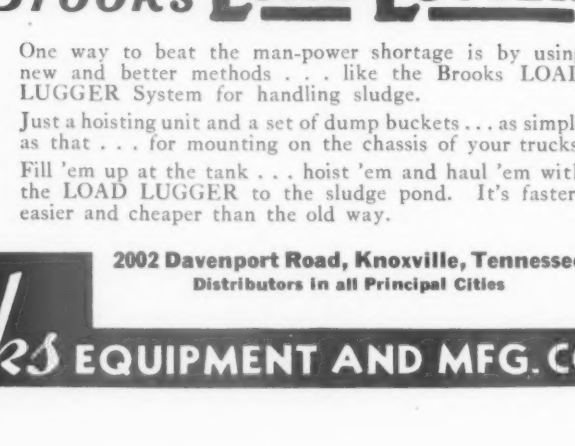

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a new employe is hired, and the supervisor must depend on others to give the initial safety instruction. Thus it is necessary for operating-personnel supervisors to know and be able to impart adequate safety instruction to newcomers. However, it is mandatory on the safety supervisor to meet the new men on his first visit to their plant or station.

It is the duty of the plant superintendent to have frequent safety conferences with his foremen and other supervisory personnel. This subject usually is a part of other conference subjects. Each foreman or crew pusher must call a safety meeting for his men at least once a month. It is up to the individual and his crew whether or not the meeting is on company time. Company policy is not involved, so the matter is one of mutual agreement between the men and their bosses. At these informal meetings safety problems, new equipment, and other points about safety are discussed round-table fashion. Every one participates and the results are as valuable to the men as to the company. Minutes are kept, copies of which go to the plant superintendent, division superintendent, division safety supervisor, and Dallas headquarters.

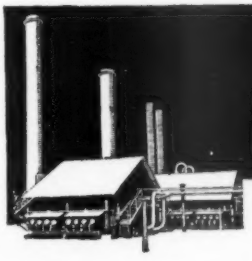
First-Aid and Fire-Prevention Training

First-aid and fire-prevention training are constant in the Magnolia company. In the beginning, the division safety supervisors were trained in first-aid by professionals qualified as instructors, with the intent of qualifying the safety supervisors as instructors also. The supervisors then picked the superintendents in their areas for training as first-aid instructors. In turn, "key" supervisory employes were picked by the superintendents and given the same sort of training. These key men select their own first-aid teams and see to it that they keep in training and teach their fellows.

Under the setup today, every new Magnolia employe receives first-aid training as a matter of course. The same practice is followed in teaching fire prevention and fire fighting. Every man learns where firefighting equipment is kept and how it works. From time to time, various kinds of fires are set in places where they can do no real harm, and the men are taught how to put them out and learn what happens if the wrong kind of extinguishing medium is used—a solid water stream on an oil fire, for example.

The company takes the position that, all-in-all, successful safety work is a matter of each man being his own safety director and that his mates for their own protection must see to it that the individual feels that way. Supervisors act in an advisory capacity only, and, by so doing, avoid creation of the psychological opprobrium of being considered "safety snoopers" and professional fault-finders. This attitude towards safety work is credited by company officials for the good showing made in the National Safety Council's contests.

Civilization made a major forward advance when primitive man learned to enjoy the benefits and luxury of fire in his home. A hole in the roof was the first rude flue so vital to fire control. Today science and engineering apply the value of fire to virtually every activity of civilization. Perhaps there is no more important application of fire than to the controlled heating of hydrocarbons. Alcorn pioneered in the scientific design and construction of heaters for processing every type of petroleum product. High production efficiency, low operation costs in many important refineries the world over are in no small measure the result of Alcorn installations. Alcorn engineering backed by its 20 year successful record is at your disposal.



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WIDENING HORIZONS

Views on Personnel, Management and Economic as Well as Technological Developments in Petroleum Refining and Natural Gas Processing

The importance and scope of scientific developments in refining the past few years have brought technologists in closer touch with many of the broader personnel and management problems of plant operation. This page in NATIONAL PETROLEUM NEWS' Technical Section is offered for the discussion of these as well as scientific matters. Contributions from readers will be greatly appreciated by the editors.

New Analytical Techniques Keep Pace with Processes

MUCH ATTENTION has been devoted of late to the many new refining processes for making war products, or improving other essential petroleum products. Equally important has been the development of new analytical and process-control techniques required with these new processes. Many of these techniques are equally valuable when applied to the older refining processes. In particular, two analytical techniques which are believed adaptable to automatic process control have come rapidly to the fore in the last two years. They are "new" in that they are applications to petroleum refining of scientific phenomena well-known to physicists for more than a decade. Both utilize the principles of electronics.

One of these methods involves the use of the so-called mass spectrometer, which makes a record of the individual masses of ionic fragments into which a gaseous sample is broken under electron bombardment. From this record both qualitative and quantitative interpretations can be made. The other modern analytical technique is the infrared spectrometer, which records the absorption of specific wave lengths of infrared light by the vibration of the atoms composing the molecules of the hydrocarbon compounds. Although the fundamental physical principles underlying the two instruments are both different and highly abstruse to any one but a physicist, yet the instruments can be operated, and results interpreted, by well trained high school graduates.

Contrast the analysis of a typical C_4 stream from a modern cracking unit, or a C_3 cut from a "wet" natural gas, using the mass or infrared spectrometer, with an analysis by chemical means or by precise fractional distillation. Using either of the latter two methods, minimal time for a complete analysis (of questionable accuracy for some components) will certainly not be less than several hours if only four components are present out of the large number possible. With the mass spectrometer, reports indicate accurate analytical results will be available in from 15 minutes to two hours, depending on the complexity of the mixture and the accuracy of required determination. With the infrared spectrometer, analytical time probably will vary from as little as five minutes to two hours, depending on the same conditions. Think what this shortened product analysis time means to process control or in getting a unit on-stream!

Another possibility is inherent in both instruments. They can be hitched to routine process control under conditions of automatic or semi-automatic operation, making a record of their performance similar to that of the familiar temperature or pressure recorder-controller. Indeed, this already has been done in the case of the infrared spectrometer, which a chemical manufacturer now is using to continuously analyze a hydrocarbon gas stream in the automatic control of a distillation process.

In the not too far-distant future many industrial chemicals, plastics, and other new products will be made from petroleum. The petroleum products serving as raw materials will have to meet high standards of purity. This will require high-precision process control in their manufacture. For example, butadiene for Buna-S synthetic rubber manufacture is required to have a minimum purity of 98.5%. Chemical and precise fractional distillation analyses are inadequate to provide the high degree of process control required. Either the mass spectrometer or the infrared spectrometer, however, will readily indicate quantities and identity of the usual impurities in butadiene in a matter of minutes, it is said.

It would not be surprising to find, in the next few years, that natural gas, for example, will be priced not on its Btu content, charcoal test, or specific gravity, but on its content of specific hydrocarbons as measured by an instrument of the type of the mass or infrared spectrometer. The gasoline plant itself probably will control distillations with the same instrument, suitably modified for process control, rather than by running a fractional distillation analysis once or twice a week. In the refinery, the "B-B" cut from the cracking units will be similarly scrutinized for content of butadiene, butylenes, isobutane and butane, for use in chemicals manufacture or for polymerizing, isomerizing and cycling processes. Gases from its vapor-recovery plant will likewise be checked before "waste" gases are sent to the boilers, or vented. Continuous spectrometric records may be made of products as they go into containers, or as they are finally blended, with copies to be sent to the buyer along with the invoice. The possibilities are legion.

In the research laboratory, the "molecule mechanic" may be using a mass spectrometer, an infrared spectrometer, and maybe a Raman and ultraviolet spectrometers too, as an identifying means in the isolation and recovery of some of the at-present elusive hydrocarbon compounds in petroleum, or as leading to the synthesis of compounds not occurring naturally but desirable as materials for new products. Perhaps he will find that only certain types of high molecular weight hydrocarbons should be used in lubricating oils and greases. Maybe it isn't too far fetched to believe that eventually the actual types and possibly the individual components which make up a sample of that still mysterious fluid —crude oil—will be completely determined by these or other instruments. Perhaps large industrial users will be inspecting petroleum products with similar instruments, not only to check with the manufacturer's specifications, but to determine more scientifically how to use the product in their own operations.

Highly remarkable achievements have been made by the petroleum industry in providing the products essential to modern warfare which will also be extensively used in the days of peace to come. No small part of the credit for what has been done should go to the analytical and control chemists, whose new methods and techniques are keeping pace with developments in processing.

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of Refining Technology Articles

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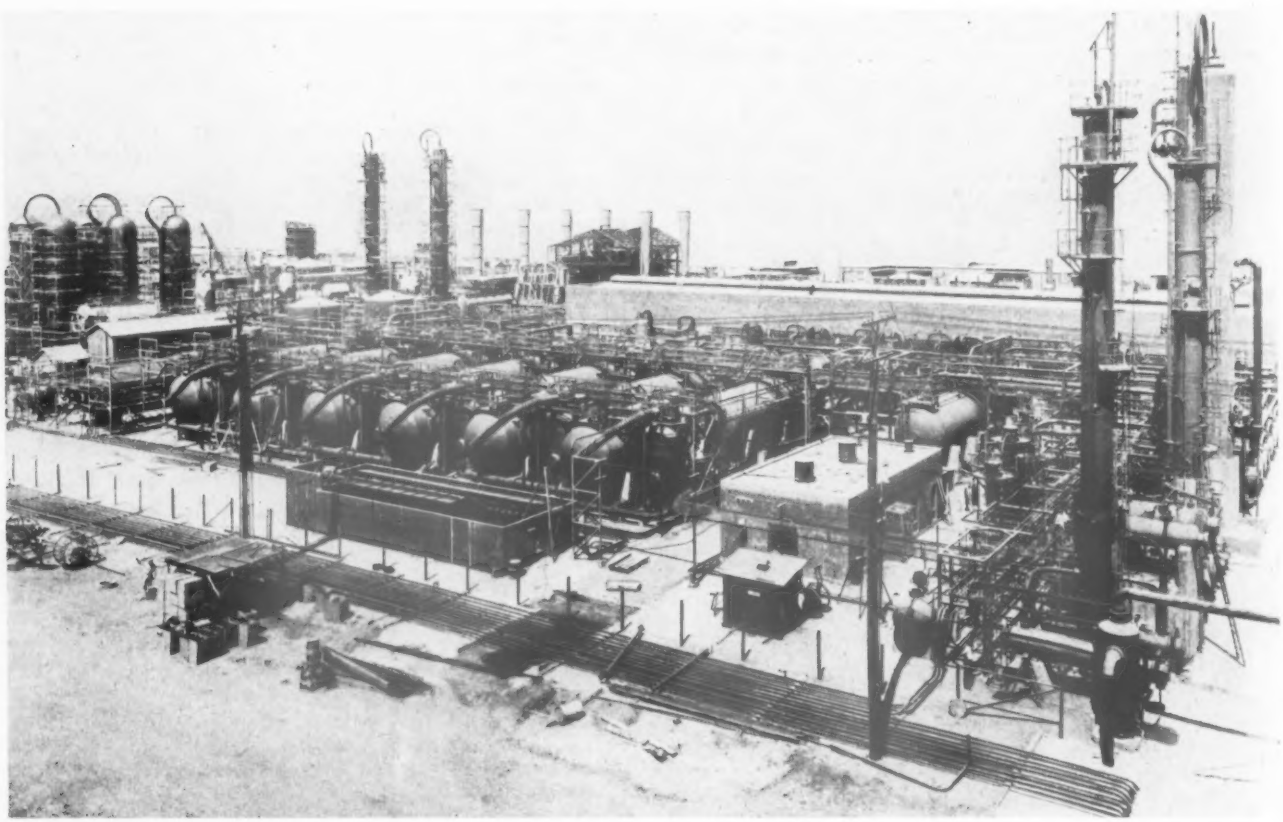

Elimination of buildings to lessen the chances for hazardous concentrations of vapors and the installation of special ventilation, purging and other mechanical safety features in design and construction, are typical of the new butadiene plants. This is the huge new plant of the Shell Chemical Co. in southern California. About 4000 tons a month of synthetic rubber can be produced as a result of its butadiene output. The plant was engineered and constructed by M. W. Kellogg Co., refinery engineers

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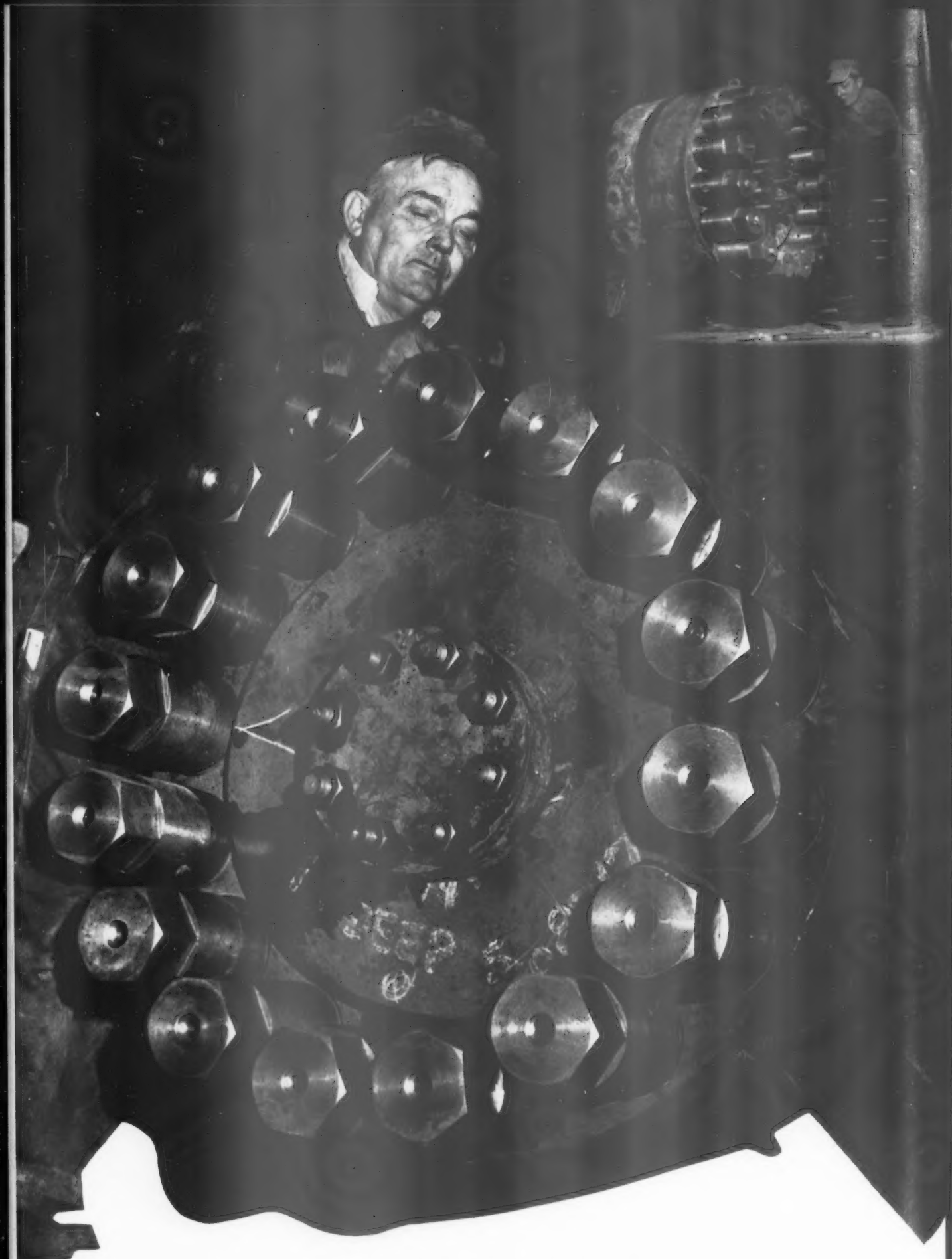

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